



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

ENER LIBRARY



H736 /

Sci 1520.71.3



Harvard College Library

FROM

The Chief of Engineers.

11 Jan., 1890.

SCIENCE CENTER LIBRARY







MEMORANDUM.

Colonel ROBERT requests that he be notified of any errors detected in this Index.

FOR
RIVER AND HARBOR IMPROVEMENT,
VOL. II.—1880-1887.

COMPILED UNDER THE DIRECTION OF
Lieut. Col. HENRY M. ROBERT, Corps of Engineers.

BY
LOUIS Y. SCHERMERHORN, C. E.,
AND
HOLDEN B. SCHERMERHORN.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1889.



U.S.—Engineer department



ANALYTICAL AND TOPICAL INDEX
TO THE REPORTS OF
THE CHIEF OF ENGINEERS
AND THE OFFICERS OF THE CORPS OF ENGINEERS,
UNITED STATES ARMY,
UPON
WORKS AND SURVEYS
FOR
RIVER AND HARBOR IMPROVEMENT,
VOL. II.—1880-1887.

COMPILED UNDER THE DIRECTION OF
Lieut. Col. HENRY M. ROBERT, Corps of Engineers.

BY
LOUIS Y. SCHERMERHORN, C. E.,
 AND
HOLDEN B. SCHERMERHORN.

WASHINGTON:
 GOVERNMENT PRINTING OFFICE.
 1889.

36.926

Sol 15207113

JAN 11 1964

The City of Engineers

CONTENTS.

	Page.
(1) LETTER OF THE CHIEF OF ENGINEERS to the Secretary of War.....	5
(2) LETTER OF COL. ROBERT to the Chief of Engineers explaining the differences between this volume and the first volume of the index.....	7
(3) EXPLANATION OF PLAN OF INDEXING EACH WORK, and meaning of terms used.	9
(4) INDEX OF EXAMINATIONS, SURVEYS, AND WORKS FOR IMPROVEMENT OF RIVERS AND HARBORS, the rivers and harbors (including creeks, sounds, bays, passes, bayous, lakes, canals, etc.) being entered under their proper names in alphabetical order; all bridges are entered immediately after "Bridging the navigable waters of the United States," the entries being made alphabetically with reference to the locality and not the river. (For explanation of the plan of indexing each work, see page 9)	11
(5) TOPICAL INDEX OF ENGINEERING AND PHYSICAL DATA, ETC., the topics being entered alphabetically	577
(6) PERSONAL INDEX, containing the names of contractors and civil employes who are mentioned in the reports, with references to the title in the main index (4) of each work upon which they were engaged.....	587
(7) SUMMARY OF APPROPRIATIONS for each work and survey for improvement of rivers and harbors from the earliest date to and including the act of August 11, 1888, with totals by States	611
(8) LIST OF PRIVATE, CORPORATE, AND STATE WORK on rivers and harbors.....	623

**OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 6, 1888.**

SIR: I have the honor to submit the inclosed letter from Lieut. Col. Henry M. Robert, Corps of Engineers, dated November 30, 1888, forwarding manuscript of the second volume of the "Index to the Reports of the Chief of Engineers on River and Harbor Improvements," and beg to remark that 1,000 copies of the first volume were printed by authority of the Secretary of War in 1881, and the edition is nearly exhausted. The work has proved to be of more value, not only to officers of the Corps of Engineers, but also to the legislative and executive departments of the Government and civil engineers, than was anticipated when the first volume was published, and has become a necessity to persons seeking information in regard to the operations of the Engineer Corps as well as in reference to engineering details generally.

In view of the above statements, it is respectfully recommended that 1,500 copies of the second volume be printed at the Government Printing Office, and, to save expense in case further editions are called for, that it be stereotyped.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. WM. C. ENDICOTT,
Secretary of War.

WAR DEPARTMENT, December 29, 1888.

Approved. The usual requisition for printing and binding will be made.

By order of the Acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

**UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., November 30, 1888.**

GENERAL: I have the honor to forward herewith the manuscript of the second volume of the "Index to the Reports of the Chief of Engineers on River and Harbor Improvements," which was undertaken in September, 1887, at the suggestion of your predecessor.

The first volume, which was published in 1881, covered the reports from 1866 to 1879, inclusive. The present volume continues the work from 1880 through the last published report of the Chief of Engineers, namely, 1887; it also includes the appropriations made by the river and harbor act of August 11, 1888.

The first volume of the Index covers fourteen years, and was compiled from twenty-three volumes of reports, while the present volume covers only eight years, but was compiled from twenty-seven volumes of reports. The plan adopted in compiling the first volume has been modified in the following respects in the present volume:

(1) The Topical Index has been placed at the end of this volume, instead of the beginning. This is equally convenient for reference, while it permits the main part of the work to go to press when completed, without delaying the publication several months for the topical portion, that has to be compiled last.

(2) Six of the sub-headings used in the former volume have been omitted, as follows: (a) "Defense," "Documents," and "Secretary of War" have been omitted, because there are no references of value to be made under those headings from the reports indexed in this second volume. (b) "Estimates" has been omitted as a separate heading, because the estimate of cost of a plan or project can be better understood when given in connection with the description of the plan or project, as is always done in this volume. (c) "Expenditures" has been omitted as a heading, as the expenditures form almost a necessary part of the history of the projects which is now given under the heading of projects. (d) "Financial Statements" is omitted as a heading, because these statements are of only temporary value or interest, and a financial statement is uniformly placed at the close of the annual report upon each work both by the officer in charge and by the Chief of Engineers.

(3) While the following sub-headings have been retained, the scope of their references has been diminished: (a) "Commerce" now contains only references to special allusions to the value of the commerce involved in the improvement, and omits all references to the routine commercial statistics which are required with every annual report and which are

uniformly printed at the close of each report. (b) "Contracts" no longer includes proposals, as the references would generally be the same. Under the heading "Contracts" brief statements of the cost of the work are made when the character of the work would permit.

(4) The following sub-headings have been added, as the references under them could scarcely with propriety be placed under any sub-heading formerly used: (a) "Legal Proceedings" is designed to include references to the proceedings of courts and the Department of Justice. (b) "Obstructions" includes references to artificial obstructions to the navigation of water ways, as bridges, dams, etc.

(5) "Projects." The most difficult subject in the Index is that of projects. Commencing as this volume does at 1880, it seemed best, as a rule, to give a brief history of the previously approved projects for each work. This has been done as far as the printed reports would permit, though in many cases it has been difficult to determine exactly through what modifications the project has passed. Sometimes it has been modified by the recommendation of the officer in charge, or by a Board of Engineers whose reports have not been published in the Annual Reports of the Chief of Engineers, and the allusions to such reports are not always sufficiently in detail to enable others to clearly understand the modifications.

The former volume of the Index was mainly compiled by Assistant Engineer L. Y. Schermerhorn and Dr. S. O. L. Potter, my chief clerk at the time. The original compilations for this volume have been made by Mr. Holden B. Schermerhorn and Assistant Engineer L. Y. Schermerhorn, the latter having also made a thorough revision of the entire manuscript, besides immediately supervising the original compilation.

To Mr. H. A. Wendell, who has copied all the original memoranda for this volume, is due great credit for his accuracy, faithfulness, and intelligent interest in the work.

Hoping that this additional volume of the Index may prove of service in rendering the reports of the Chief of Engineers more available for reference, I am,

Very respectfully, your obedient servant,

HENRY M. ROBERT,

Lieut. Col. of Engineers, U. S. A.

THE CHIEF OF ENGINEERS, U. S. A.

EXPLANATION.

The first division, which comprises the main body of the work, is arranged for each improvement under the following headings:—

APPROPRIATIONS: Including an aggregate of all appropriations made by Congress prior to 1880, and in detail appropriations from 1880 to and including the act of August 11, 1888.

COMMERCE: Including only special allusions to commerce; routine commercial statistics required with each annual report are not included, as they are to be found at the end of each report.

CONTRACTS: Including contracts, with prices, but not proposals.

ENGINEERS: Subdivided as follows: (1) *Chief of Engineers*; (2) *Boards of Engineers*, when any such were appointed in connection with the work; (3) *Engineers in charge*; (4) *Assistants*.

[**ESTIMATES:** Always incorporated with Plans and Projects.]

LEGAL PROCEEDINGS: Including proceedings of courts, Department of Justice, etc.

LEGISLATION: By Congress or the several States, except the acts making appropriations and ordering surveys.

[**MAPS:** Placed as a sub-heading under Surveys whenever published in the reports.]

OBSTRUCTIONS: Including all artificial obstructions to navigation, as bridges, dams, etc.

OPERATIONS: Including a brief statement of the operations of each year.

PHYSICAL CHARACTERISTICS: Including references to the physical geography of localities, the gauging of rivers, rainfall, drainage areas, etc.

PLANS: Including all plans proposed which were not adopted by authority as the projects for the improvement. (See Projects, below.)

PRIVATE, CORPORATE, AND STATE WORK done on the improvement, as far as mentioned in the reports.

PROJECTS: As adopted by the engineer in charge or Boards of Engineers, with the estimated cost of each, and such details as are of greatest importance, with full references to the same and to any modifications made; together with a brief history of the approved projects previous to 1880. (See Plans, above.)

SURVEYS: Including references to Examinations and Surveys made and to Maps published in the reports.

The indexes of Examinations and Surveys, where no improvements have been made, and of Bridges over Navigable Waters, are arranged in a somewhat different manner from works of improvement, according to the material on hand.

ABBREVIATIONS AND REFERENCES.

The few abbreviations used (as Maj., Col., lin. ft., cub. yds., etc.) will be readily understood. The references to the Annual Reports of the Chief Engineers are printed with the year (omitting the "18") in heavy face type, and the page in ordinary type, thus: "186, 1921." In the report of 1877 the plan was commenced of paging each annual report continuously, regardless of volumes, and therefore the number of the volume is ignored in the references in this Index, excepting where it is necessary to refer to a report prior to 1877, when the volumes are indicated by the Roman numerals, i, ii, iii, iv.

INDEX
OF
WORKS AND SURVEYS FOR
IMPROVEMENT OF RIVERS AND HARBORS.

ABSECON INLET, N. J.—(See ATLANTIC CITY HARBOR, N. J.)

AGATE BAY, MINN.—IMPROVEMENT OF.

Appropriations.

1886..... \$22,500, '87, 1952.
1888..... 15,000, act of August 11, 1888.

Commerce.

Necessity for improvement, '85, 1955-1958.

Contracts.

1887. Steele Bros. & Co., for 500 linear feet of breakwater construction, '87, 1953.

Engineers.

CHIEF OF ENGINEERS.

Reports, '85, 296; '87, 255.

ENGINEERS IN CHARGE.

Maj. C. W. Allen. Report, '85, 1954, 1955.

Capt. J. B. Quinn, 1886— Report, '87, 1951.

ASSISTANTS.

R. Hunt. Report, '85, 1957.

J. P. Parkinson. Report, '85, 1954.

Operations.

1886-'87. Preparations for breakwater extension, '87, 1952.

Plans.

By Maj. Allen, 1885, for the construction of a breakwater in Agate Bay 1,200 feet in length, and in Burlington Bay 1,100 feet in length, with the deepening of the areas behind the breakwaters by dredging; estimated cost, \$430,000, '85, 1956.

Physical Characteristics.

Description of bays, '85, 1954; '87, 1951. Direction of winds from, 1873-'83, '85, 1959.

Projects.

By Capt. Quinn, 1887, for the construction of two breakwaters in Agate Bay, respectively 1,000 and 900 feet in length, and extending from the easterly and westerly points of the bay; the opening between the ends of the breakwaters to be 1,340 feet; the area inclosed, 109 acres; estimated cost, \$213,000, '87, 1951.

Surveys.

Ordered by act of July 5, 1884. Made under the direction of Maj. Allen, 1885, '85, 1955.

MAPS.

'87, 1952.

AHNAPEE HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 44.)

Appropriations.

1871-'79	\$163,000.
1880	7,000, '80, 1911.
1881	8,000, '81, 2079.
1882	12,000, '82, 2139.
1884	15,000, '84, 1848.
1886	15,000, '86, 1662.
Total	160,000
1888	5,000, act of August 11, 1888.

Commerce.

Present limited area of harbor inadequate for demands of commerce, '81, 2079.
Neglect of local authorities to preserve improvements made, '82, 272, 2139, 2140.
Improper use of United States piers by local interests, '85, 1990; '87, 2038.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 204; '81, 275; '82, 271; '83, 280; '84, 280; '85, 303; '86, 297; '87, 262.

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert, 1875-'83. Reports, '80, 1910; '81, 2077; '82, 2077.

Capt. F. A. Hipman, 1883. Report, '83, 1678.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1847; '85, 1990; '86, 1662.

Capt. W. L. Marshall, 1886, '86, 290.

Capt. C. E. L. B. Davis, 1886—'. Reports, '86, 1662; '87, 2037.

ASSISTANTS.

L. Y. Schermerhorn. Report, '80, 1911.

C. Crossman. Report, '80, 1910.

Operations.

1879-'80. 4,795 cubic yards of rock removed by United States dredge; 620 feet of pile pier revetted; cost of rock removal by dredge, cost of pile pier revetment, '80, 1911, 1914.

1880-'81. 10,980 cubic yards of rock removed by drilling and blasting and use of United States dredge; 6,400 cubic yards of rock removed to adjacent harbors for pier-filling; details of rock removal, '81, 276, 2077.

1881-'82. Two cribs built with timber from United States reservation at Sturgeon Bay, '82, 2077.

1882-'83. 23,587 cubic yards sand and mud and 4,820 cubic yards rock removed by hired labor and use of United States dredge; 12 cribs built and 9 sunk in extension of piers; timber for crib-building used from United States reservation, and rock for crib-filling from excavation of interior harbor; cost of crib construction and rock removal, '83, 280, 1680, 1689; removal of 1,198,644 feet B. M. timber from United States reservation at Sturgeon Bay, '83, 1679.

1883-'84. No operations, '84, 1847.

1884-'85. 100 linear feet pier extension; 6,413 cubic yards rock and 4,478 cubic yards of sand removed by hired labor and use of United States dredge; 450 linear feet of superstructure built. Cost of rock removal and pier construction; saving in cost of work by use of timber from United States reservation, and rock for crib-filling from harbor excavation, '85, 303, 1990, 1991.

1885-'86. Removal of 20 cubic yards rock from inner harbor by United States dredge. History of past operations, '86, 1662.

1886-'87. No operations from proviso in act of August 5, 1886, that wharfage over the United States piers must be made free, '87, 2038.

Projects.

The original project of 1870, by Maj. Houston, proposed the formation, by pier extension and dredging, of an outer harbor covering the mouth of Ahnapee River; estimated cost, \$370,000, '71, 125; '72, 118; '76, ii, 351.

In 1873 the project was modified to provide for the formation of a small harbor at the mouth of the river, which might be subsequently utilized should the larger outer harbor ever be required. Estimated cost, \$100,000, '73, 200; '76, ii, 351.

In 1875 Maj. Robert proposed the extension of the piers, provided for under the project of 1873, to the 18-foot curve in Lake Michigan, and the formation of an inner harbor 100 feet wide and 12 feet deep, extending from the highway bridge to the mouth of the river, at an estimated cost, in addition to the project of 1873, of \$95,000, or at an aggregate cost of \$175,000, '76, ii, 346-359; increased by Board of Engineers, '76, ii, 346.

In 1884 the project was modified by increasing the width of entrance to the piers to 200 feet, '85, 1990.

ALABAMA RIVER, ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 45.)

Appropriations.

1878-'79	\$55,000, '78, 81; '79, 104.
1880	25,000, '80, 1063.
1881	20,000, '81, 1200.
1882	20,000, '83, 1009.
1884	10,000, '85, 1307.
1886	15,000, '86, 1172.

Total..... 145,000

1888..... 20,000, act of August 11, 1888.

Commerce.

Advantages arising from improvement, '80, 1065; '81, 1203; '83, 1010; '85, 1306; '86, 1171.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 137; '81, 186; '82, 182; '83, 194; '84, 203; '85, 203; '86, 201, '87, 170.

ENGINEERS IN CHARGE.

Maj. A. M. Damrell, 1876-1885. Reports, '80, 1083; '81, 1200; '82, 1278; '83, 1008; '84, 1200.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1306; '86, 1171; '87, 1288.

Operations.

History of past operations, '80, 1083; '82, 1281; '83, 1010.

1879-'80. Completion of dam across "Cut-off;" 3 chutes closed at Haynes' Island; partial closure of chutes at Erwin's Bar, Hobb's Bar, and Yellow Jack Bar, and the removal of 490 snags from the river, '80, 1084.

1880-'81. Completion of improvement at following bars: Gardner's Island, Cox's Bar, Hadnot's Bar, Three Chutes, and bar below Cut-off, '81, 186, 1201.

1881-'82. Repair of dam at Cut-off and Hobb's Island; completion of dam at Gardner's Island, '82, 1279. Summary of work done, '82, 1280.

1882-'83. Summary of work done, '83, 1009.

1883-'84. Operations limited to removal of overhanging trees and snags, '84, 1201.

1884-'85. Removal of snags and logs, '85, 1306.

1885-'86. Removal of snags and logs and closing low-water chute by brush dam near Gardner's Island, '86, 1171.

1886-'87. Removal of obstructions between mouths of the Alabama and Tallapoosa rivers, '87, 1288.

Physical Characteristics.

General widths and depths, '82, 1279.

Projects.

By Capt. Damrell, 1876, for the improvement of the river from its mouth, 50 miles above Mobile, to Wetumpka, Ala., a distance of 323 miles; by the removal of logs and snags, and by the construction of wing-dams and jetties, so as to give a channel 200 feet wide and 4 feet deep at mean low water, at an estimated cost of \$229,741, '76, 1, 498, 507; '85, 203.

Surveys.**MAPS.**

From mouth to Wetumpka, '84, 1202.

ALAMEDA CREEK, CAL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 334.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '84, 2207.

ASSISTANT.

Lieut. C. F. Palfrey. Report, '84, 2207.

Plans.

Col. Mendell did not consider the work to be a public necessity, '84, 2207.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Col. Mendell, 1882, '84, 2207.

ALEXANDER HARBOR, MO.—(See MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER.)

ALLEGHENY RIVER, PA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 46.)

Appropriations.

1879.....	\$10,000, '79, 144.
1880.....	20,000, '80, 1767.
1881.....	25,000, '81, 1947.
1882.....	15,000, '82, 1934.
1884.....	35,000, '85, 1818.
1886.....	{ 30,000, '86, 1545.
	{ 37,500,* '86, 1546.
Total	172,500
1888.....	{ 25,000, act of August 11, 1888.
	{ 35,000*

Commerce.

Statistics, '80, 1765, 1766, 1773; '83, 1553. Necessity for improvement of river at Pittsburgh, '76, ii, 149; '80, 1767; '84, 1702; '86, 1545.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 193, 195; '81, 261; '82, 256; '83, 264; '84, 262; '85, 283; '86, 273; '87, 239.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1876.—. Reports, '80, 1764, 1767; '81, 1945; '82, 1931; '83, 1550; '84, 1702; '85, 1818; '86, 1544; '87, 1810, 1811.

ASSISTANTS.

T. P. Roberts. Report, '80, 1765; 1768.

J. B. Dougherty, '80, 1767.

J. V. Hoag, '81, 1945. Reports, '82, 1931; '83, 1551.

Legislation.

Required by State of Pennsylvania giving United States jurisdiction over land required for lock and dam at Pittsburgh, '86, 274, 1545; '87, 1812.

Operations.

History of the past, '80, 1765.

1879-'80. Construction of dams at Six-Mile Island, Nicholson's Rapids, and Garrison's Ripple. Dredging at mouth of river and purchase of snag-boat, '80, 1765.

1880-'81. Repairs to dams at Six-Mile Island and Nicholson's Rapids. Removal of snags and rocks, '81, 1945.

1881-'82. Repairs to dams at Six-Mile Island and Nicholson's Rapids. Removal of rocks and snags, '82, 1931.

1882-'83. Removal of 301 snags and 23,513 cubic yards rock, '83, 1551.

1883-'84. No operations for lack of funds, '84, 1702.

1884-'85. Repairs to dam at Nicholson's Rapids. Removal of 70,649 cubic yards of rock, 3,555 cubic yards gravel, and 848 snags, '85, 1819.

1885-'86. No operations for lack of funds, '86, 1544.

1886-'87. Removal of rock from river channel and preparation for construction of inclined plane at Corydon Dam, '87, 1810.

Physical Characteristics.

General description, '80, 1767, 1769. Floods, slope, '80, 1769.

Plans.

By Lieut. Col. Merrill, 1876, for the improvement of the river at Pittsburgh by the construction of a lock and dam at Garrison's Ripple, at an estimated cost of \$153,000, '76, ii, 149; '80, 1767; '82, 1933. Probability that further consideration will increase estimate, '86, 1545. Estimated cost, \$400,000, '87, 1812.

Private and Corporate Work.

Pipe lines laid by natural-gas companies across the bed of the river, '85, 1920.

Projects.

By Lieut. Col. Merrill, 1879, for temporary improvement by means of wing-dams and removing obstructions, '79, 1371.

By Lieut. Col. Merrill, 1879, for the temporary improvement of the river by removal of rocks from channels and closing low-water chutes behind islands, '79, 1371; '86, 273.

Surveys.

1879. By T. P. Roberts, from French Creek, Pa., to Olean, N. Y., '80, 1767.

* For dam at Herr's Islands, '86, 1546; '87, 1812.

ALLIGATOR RIVER, N. C.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '84, 177; '87, 123.

ENGINEERS IN CHARGE.

Capt. J. Mercur. Reports, '84, 1059; '87, 992.

Capt. F. A. Hinman. Report, '87, 991.

Plans.

Capt. Mercur did not consider the river as worthy of improvement or the work a public necessity, '84, 1059.

In 1886, Capt. Hinman did not consider the stream worthy of improvement, '87, 993.

Surveys.

Examination ordered by act of August 2, 1882, August 5, 1880. Made under direction of Capt. Mercur, 1882, '84, 1059, and Capt. Hinman, 1886, '87, 991.

ALLIGATOR RIVER, S. C.—SURVEY OF.**Commerce.**

Present and prospective, '87, 1123.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 139.

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '87, 1114, 1117.

ASSISTANT.

R. Whitford, '87, 1118.

Physical Characteristics.

Description, '87, 1114.

Plans.

By Capt. W. H. Bixby, 1887, for improvement of Alligator River and waters connecting Santee River and Bull's Bay by excavation of a 6-foot channel, 100 feet in width; estimated cost, \$183,240, '87, 1118.

Surveys.

Examination and survey ordered by act of August 5, 1886. Made 1887 under direction of Capt. Bixby, '87, 1117.

MAPS.

'87, 1118.

ALPENA HARBOR, THUNDER BAY, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 47.)

Appropriations.

1876..... \$4,500, '77, 111, 142, 934.

1882..... 15,000, '83, 1853.

Contracts.

1883. C. S. Barker, for dredging, at 20 cents per cubic yard, '83, 1853.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 219; '81, 297; '82, 292; '83, 301; '84, 303; '85, 327; '86, 321; '87, 299.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1878-1883. Reports, '80, 2036; '81, 2244; '82, 2329.

Maj. F. U. Farquhar, 1883, '83, 299.

Lieut. Col. O. M. Poe, 1883-'— Reports, '83, 1852; '84, 2036; '85, 2129; '86, 1125; '87, 2249.

ASSISTANT.

R. Strohman. Report, '84, 2037.

Operations.

1879-'82. None, '80, 2036; '81, 2245; '82, 2329.

1882-'83. 16,900 cubic yards dredged, '83, 1852.

1883-'84. 21,294 cubic yards dredged, '84, 2040.

ALPENA HARBOR, THUNDER BAY, MICH.—Continued.**Operations—Continued.**

1884-'85. No operations, '85, 2129.

1885-'86. No operations, '86, 1825.

1886-'87. No operations; project completed in 1884, '87, 2249.

Projects.

By Maj. Harwood, 1881, for obtaining a channel 14 feet deep by dredging, at an estimated cost of \$25,000, '81, 2244; '84, 2037; project completed 1884, '87, 2249.

ALSEA RIVER AND BAY, OREGON—SURVEY OF.

(Continued from Vol. I, p. 48.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 242.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie. Report, '80, 2338.

ASSISTANT.

R. A. Habersham. Report, '80, 2337.

Physical Characteristics.

'80, 2337.

Projects.

Lieut. Col. Gillespie in 1879 considered the harbor as not worthy of improvement, '80, 2336.

Surveys.

1879. By R. A. Habersham, '80, 2337.

ALTAMAHA RIVER, GA.—IMPROVEMENT OF.**Appropriations.**

1881..... \$5,000, '81, 1105.

1882..... 15,000, '82, 1177.

1884..... 15,000, '84, 1116.

1886..... *20,000, '86, 1108.

Total..... 55,000

1888..... 10,000, act of August 11, 1888.

Statements of appropriations, '87, 1178.

Commerce.

Importance of the improvement to commerce, '86, 1107, 1109; '87, 1177.

Contracts.

1883. R. S. Burnett, for removing rock, at \$4.70 per cubic yard, and construction of wing-dams, '83, 929.

1884. E. H. Gaynor, for construction of wing-dams, '85, 1221.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 175; '82, 170; '83, 181; '84, 187; '85, 187, 191; '86, 186; '87, 149.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1886.— Reports, '81, 1105, 1107; '82, 1176; '83, 926; '84, 1114; '85, 1218, 1234; '86, 1105; '87, 1176.

ASSISTANTS.

W. G. Williamsen. Report, '81, 1109.

Capt. J. C. Post. Report, '83, 930.

Capt. T. N. Bailey. Reports, '84, 1116; '85, 1236.

Lieut. O. M. Carter. Reports, '85, 1221; '86, 1108.

Operations.

1881-'82. Construction of snag-boat, '82, 1176.

1882-'83. Examination of river preparatory to active operations, '83, 927.

1883-'84. Removal of 1,800 cubic yards rock at Town and Piney Bluffs, 323 snags, and 185 leaning trees, '84, 1115.

* \$10,000 to be applied to Doboy Bar, '87, 1178.

ALTAMAHA RIVER, GA.—Continued.**Operations—Continued.**

1884-'85. Construction of training-wall for improvement of Beard's Bluff Bar, removal of snags and protecting caving banks, '85, 1218.

1885-'86. Construction of 4 spur-jetties at Beard's Bluff Bar, '86, 1106.

1886-'87. Removal of snags and trees by snag-boat Toccoa, '87, 1177.

Projects.

By Col. Gillmore, 1880, for the formation of a low-water channel 80 feet wide and 3 feet deep, from its confluence to Darien, 155 miles, by the removal of rock, bars, and snags, at an estimated cost of \$60,000, '81, 1106; '87, 1176.

Surveys.

1880. Examination by W. G. Williamson, '81, 1107.

1884. Map of river, '84, 1116.

1885. Map of river at Beard's Bluff, '85, 1222.

ALTON HARBOR, ILL.—(See MISSISSIPPI RIVER BETWEEN MOUTHS OF ILLINOIS AND OHIO RIVERS.)**ANBOY, FROM PERTH AND SOUTH TO MAIN SHIP-CHANNEL, BARITAN BAY—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '81, 115.

ENGINEER IN CHARGE.

Lieut. Col. N. Michler. Report, '81, 717.

ASSISTANT.

A. Doerflinger. Report, '81, 718.

Projects.

By Lieut. Col. Michler, 1880, for the formation, by dredging, of a channel 300 feet wide and 21 feet deep at mean low water, between deep water off the main ship-channel and deep water west of Seguin Point; estimated cost, \$126,500, '81, 719.

Surveys.

By A. Doerflinger, '81, 718.

AMELIA RIVER, FLA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 191.

ENGINEER IN CHARGE.

Capt. W. T. Rossell. Report, '85, 1285.

Plans.

Reference to previous examinations, '85, 1284.

In 1884 Capt. Rossell did not consider that the needs of commerce required the present improvement of the river, '85, 1285.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Rossell, 1884, '85, 1285.

AMITE RIVER, LA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 49.)

Appropriations.

1880..... \$8,000, '80, 1157.

1881..... 5,000, '81, 1260.

1886..... 2,000, '86, 1241.

1888..... 5,000, act of August 11, 1888.

AMITE RIVER, LA.—Continued.**Contracts.**

1880. E. Glascock, for the removal of obstructions, '81, 1279; unsatisfactory progress of contract, '83, 1103.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 143, 145; '81, 192; '82, 188; '83, 206; '84, 210; '85, 215; '86, 213; '87, 181.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'83. Reports, '80, 1156, 1185; '81, 1279; '82, 1372.

Maj. A. Stickney, 1883-'84. Reports, '83, 1103, '84, 1263.

Capt. T. Turtle, 1884.

Maj. W. H. Heuer, 1885.—. Reports, '85, 1391, '86, 1239; '87, 1364.

ASSISTANTS.

H. S. Douglass. Report, '80, 1185.

Capt. D. W. Lockwood. Report, '83, 1164.

H. C. Collins. Report, '84, 1264.

Operations.

1881-'82. Obstructions removed from 6½ miles of river, '82, 1372.

1882-'83. Obstructions removed from 36 miles of river, '83, 1104.

1883-'84. Operations prosecuted by hired labor; 8 miles of river cleared of obstructions, '84, 1264; '85, 1392. Advantage of work done by hired labor, '85, 1392.

1884-'87. No operations, '85, 1391; '86, 1240; '87, 1366.

Private and Corporate Work.

State of Louisiana has expended \$75,000 in clearing river of obstructions, '80, 1187.

Projects.

By Maj. Howell, 1879, for the improvement of the river from Bayou Manchac to Lake Maurepas, to a low-water depth of 5 feet, by the removal of snags and logs, at an estimated cost of \$23,760, '80, 1157. Improvement not considered permanent, '80, 1157; '83, 1105; '84, 210.

Physical Characteristics.

Description of, '80, 1186.

Surveys.

By H. L. Douglass, '80, 1185.

ANCLOTE HARBOR, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 199.

ENGINEER IN CHARGE.

Capt. W. T. Rossell. Report, '84, 1280.

ASSISTANT.

A. W. Barber. Report, '85, 1280.

Plans.

In 1884 Capt. Rossell did not consider the harbor worthy of improvement, '85, 1280.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Rossell, 1884, '85, 1280.

ANDALUSIA, ILL.—(See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)**ANDROSCOGGIN RIVER—(At and below Brunswick.) ME.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 77; '82, 77; '84, 73.

ENGINEER IN CHARGE.

Col. G. Thom. Reports, '82, 527; '84, 473.

ASSISTANT.

Lieut. W. T. Rossell. Report, '82, 528.

ANDROSCOGGIN RIVER—(At and below Brunswick,) ME.—
Continued.**Plans.**

By Col. Thom, 1881, for formation of dredged channel at Brunswick, 150 feet wide and 6½ feet deep at low water, through the shoals above Foster Island, with bank protection and closure of channel north of Cow Island; no information as to necessity of improvement or its benefit to commerce; estimated cost, \$34,000, '82, 528, 530. In 1884 Col. Thom did not consider the river worthy of improvement below Brunswick, '84, 473.

Surveys.

Ordered by act of March 3, 1881. Made under direction of Col. Thom, 1881, '82, 527.

Examination below Brunswick, '84, 473.

ANGUILLE RIVER, ARK.—(See L'ANGUILLE RIVER.)

ANNAPOLIS HARBOR, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 49.)

Appropriations.

1880..... \$5,000, '80, 634.
1881..... 5,000, '81, 874.

Commerce.

Benefit to commerce from proposed improvement small, '81, 874; '82, 850; '85, 134.

Contracts.

1886. The American Dredging Company, at 8 cents per cubic yard, '86, 877.

Defense.

Strategic value of Annapolis Harbor, '82, 850; '85, 134.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 102; '81, 135, 150; '82, 131; '83, 136; '84, 143; '85, 134; '86, 134; '87, 98.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1876-'—. Reports, '80, 633; '81, 871; '82, 850; '83, 676; '84, 900; '85, 886; '86, 877; '87, 863.

ASSISTANT.

W. R. Hutton. Report, '81, 872.

Operations.

Appropriations withheld until further action of Congress, '81, 861; '85, 134.

1885-'86. Dredging shoals within the harbor, '86, 877.

1886-'87. Dredging of shoals continued, '87, 863.

Physical Characteristics.

General description, '81, 872.

Project.

By Lieut. Col. Craighill, 1880, for improvement of harbor by the formation of a channel through the bars abreast of the Naval Academy, by dredging 150 feet wide and 24 feet deep at low water; estimated cost, \$86,000, '81, 872; '85, 134.

Surveys.

1886. By Mr. W. F. Smith, of shoals in harbor, '86, 134.

APALACHICOLA BAY, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 50.)

Appropriations.

1828-'38..... \$31,700
1880..... 10,000, '80, 1077.
1881..... 10,000, '81, 1191.

APALACHICOLA BAY, FLA.—Continued.**Appropriations—Continued.**

1882.....	25,000, '82, 1267.
1884.....	10,000, '84, 1177.
1886.....	12,000, '86, 1141.

Total 98,700

1888..... 20,000, act of August 11, 1888.

Commerce.

Increase of, due to improvement, '82, 1267; '84, 1176.

Contracts.

1880. W. A. Alexander, dredging, at 46½ cents per cubic yard, '81, 1190.

1881. J. Thomlinson, dredging, at 29½ cents per cubic yard, '82, 1269; '83, 960.

1882. J. Maguire, dredging, at 22½ cents per cubic yard, '83, 960.

1885. S. N. Kimball, dredging, at 29½ cents per cubic yard, '85, 1259.

1886. S. N. Kimball, dredging, at 39½ cents per cubic yard, '87, 1265.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 136; '81, 183; '82, 179; '83, 189; '84, 197; '85, 194; '86, 193; '87, 163.

ENGINEERS IN CHARGE.

Capt. A. N. Damrell, 1879-'84. Reports, '80, 1076; '81, 1190; '82, 1266; '83, 960; '84, 1175.

Capt. W. T. Rossell, 1884-'86. Report, '85, 1258.

Lieut. W. M. Black, 1886-'87. Report, '86, 1140.

Capt. R. L. Hoxie, 1887— . Report, '87, 1265.

ASSISTANT.

W. H. Barber. Report, '85, 1260.

Operations.

1881-'82. 51,943 cubic yards material dredged, resulting in increasing the channel depth from 2½ to 3 feet, '82, 1267.

1882-'83. Formation of a dredged channel 75 feet wide and 9½ feet deep, '83, 960.

1883-'84. 2,290 cubic yards dredged, resulting in a channel from 60 to 75 feet wide and 9½ feet deep, '84, 1176.

1884-'85. 27,000 cubic yards removed in the formation of dredged channel 60 feet wide and 9½ feet deep, '85, 1259.

1885-'86. No operations for lack of funds, '86, 1144.

1886-'87. 4,607 cubic yards dredged at Carrabelle and 18,836 cubic yards at Apalachicola Bar, '87, 1265.

Projects.

By Capt. A. N. Damrell, 1879, for the formation, by dredging, of a channel 100 feet wide and 11 feet deep through the bar in the bay at the mouth of the river; estimated cost, \$100,000, '79, 823; '85, 1258; '87, 1265.

Not considered that the improvement will be permanent without auxiliary works, '80, 1077; '86, 193; '87, 1265.

Surveys.**MAPS.**

'86, 1142.

APALACHICOLA RIVER, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 56.)

Appropriations.

1874-'79.....	\$33,000, '74, '80, 1075.
1880.....	2,000, '80, 1075.
1881.....	1,500, '81, 1190.
1882.....	2,000, '82, 1265.
1884.....	1,000, '84, 1175.
1886.....	1,000, '86, 1155.

Total 40,500

1888..... 2,000, act of August 11, 1888.

Statement of appropriations, '87, 1264.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 135; '81, 182; '82, 178; '83, 189; '84, 197; '85, 196; '86, 1153; '87, 162

APALACHICOLA RIVER, FLA.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. A. N. Damrell, 1873-'74. Reports, '80, 1075; '81, 1188; '82, 1264; '83, 978; '84, 1174.

Capt. W. T. Russell, 1884-'86. Report, '85, 1275.

Lieut. W. M. Black, 1886-'87. Report, '86, 1153.

Capt. R. L. Hoxie, 1887-'— . Report, '87, 1263.

ASSISTANT.

M. J. Mack, '86, 1154.

Operations.

1879-'80. Canal 70 feet wide and 5 feet deep, cut between Apalachicola River and Moccasin Slough; removal of raft from Styx River, '80, 1076.

1880-'81. Removal of 676 snags and overhanging trees and 2,233 cubic yards of dredged material, '81, 1189.

1881-'82. 165 snags and overhanging trees, 2 rafts and 3,000 cubic yards of dredged material removed, '82, 1265.

1882-'83. Removal of drift from Moccasin Slough, '83, 979.

1883-'84. Widening Moccasin Slough Canal by removal of 240 cubic yards of clay and 3,679 snags and overhanging trees, '84, 1175.

1884-'85. No operations, '85, 1276.

1885-'86. Removal by hired labor of 110 snags and logs from channel above Moccasin Slough, '86, 1155; completion of improvement as originally projected, '86, 1154.

1886-'87. 33 snags and 141 leaning trees removed, '87, 1264.

Projects.

By Capt. A. N. Damrell, 1874, for the formation of a channel of navigable width and 6 feet deep, by the removal of snags and overhanging trees, and by utilizing Styx River and Moccasin Slough, in avoiding the worst part of the Apalachicola River; estimated cost, \$30,333, '73, 698. Project accomplished in 1880 by expenditure of \$37,244.57, '80, 1076. In addition to original project, Chipola Cut-off opened to White's Bluff, '82, 1265. Annual appropriation estimated for the preservation of improvement, \$2,000, '85, 1276; '86, 1154.

APPOMATTOX RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 51.)

Appropriations.

1871-'79	\$260,000, '71-'79, 51.
1880	20,000, '80, 657.
1881	20,000, '81, 901.
1882	35,000, '82, 901.
1884	25,000, '84, 913.
1886	18,750, '86, 959.

Total 378,750

1888 15,000, act of August 11, 1888.

Contracts.

1881. S. West, dredging, at 20 and 23 cents per cubic yard, '81, 902.

1882. G. H. Ferris, dredging, at 32 cents per cubic yard, '82, 901.

1884. B. A. Davis for piles, G. V. Scott & Sons for lumber, W. F. Gatling for brush and poles, '84, 914. A. F. Hull, dredging, at 13½ cents per cubic yard, '85, 1029, 1031.

1886. West Point Engine and Machine Company, for boiler of tow-boat, '87, 978.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 106; '81, 143; '82, 139, 903; '83, 143; '84, 147; '85, 155; '86, 150; '87, 117.

ENGINEERS IN CHARGE.

Lieut. Col. William P. Craighill, 1879-'84. Reports, '80, 655; '81, 898; '82, 898, 907; '83, 687; '84, 913.

Capt. F. A. Hinman, 1884-'— . Reports, '85, 1029; '86, 959; '87, 978.

ASSISTANTS.

Capt. J. W. Cuyler. Report, '80, 657.

H. D. Bird. Report, '80, 659.

Capt. T. Turtle. Reports, '82, 898, 907, 911; '83, 687.

Lieut. C. McD. Townsend. Reports, '83, 688; '84, 914.

H. J. Gielow. Report, '87, 981.

APPOMATTOX RIVER, VA.—Continued.**Operations.**

- 1879-'80. Dredging 9,305 cubic yards; repair and construction of wing-dams and dike, '80, 657.
 1880-'81. Dredging, construction and repair of wing-dams in progress, '81, 698.
 1881-'82. Dredging and repairs to dikes, '82, 898.
 1882-'83. Improved condition of river, '83, 143, 687, 694. Construction of jetties and their cost, '83, 143, 688.
 1883-'84. 26,727 cubic yards dredged; construction and repairs of dikes, '84, 147, 914. Improved condition of river, '84, 913. Cost of work, '84, 915.
 1884-'85. 51,300 cubic yards dredged by contract from Puddledock Cut; extension and repair of dikes by hired labor, '85, 1029.
 1885-'86. 70,124 cubic yards dredged by contract from Puddledock Cut; 190 linear feet pile and brush revetments built by hired labor '86, 958.
 1886-'87. 25,047 cubic yards dredged from channels; repair of jetties, dams, and training-walls; 348 linear feet revetment built at Puddledock Cut; construction of training-wall at Rushmore's commenced, '87, 979.

Private and Corporate Work.

- Construction of a dredge, 1884, by city of Petersburg, Va., '84, 914; work done by city of Petersburg, '86, 960.

Projects.

- By Board of Engineers, 1870, for the attainment of a channel with a depth of 12 feet at high water, and a width as great as the river will bear; the improvement to be accomplished by regulating works, aided by dredging when the needs of commerce require a more rapid improvement of the channel than could be obtained by the regulating works; estimated cost \$428,000, '71, 73, 606; '85, 155; '87, 117.

- In 1887 a revision of the estimated cost for the completion of the project was \$33,810, '87, 978, 988.

Surveys.

- 1881-'82, under direction of Lieut. Col. W. P. Craighill, '82, 904.

APPOQUINIMINK CREEK, DEL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '81, 129.

ENGINEER IN CHARGE.

Col. J. N. Macomb. Report, '81, 826.

ASSISTANT.

W. S. Edwards. Report, '81, 826.

Plans.

- By Col. Macomb, 1880, for improvement of creek by dredging from Odessa to its mouth, a distance of 9½ miles, so as to give 6 feet depth at mean low water; estimated cost, \$71,382, '81, 826.

Survey.

1880. By W. S. Edwards, '81, 826.

ARANSAS PASS AND BAY, TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 53.)

Appropriations.

1879.....	\$35,000
1880.....	65,000, '80, 1247.
1881.....	80,000, '81, 1359.
1882.....	100,000, '82, 1471.
1884.....	100,000, '84, 1316.
1886.....	101,250, '86, 1333.

Total..... 481,250
 1888..... 100,000, act of August 11, 1893.

ARANSAS PASS AND BAY, TEX.—Continued.

Contracts.

1881. F. Brunner, for brush, at \$3.35 per cord; contract completed May, 1882, '82, 1469; C. M. Holdin, for stone, '82, 1469.

1882. A. M. Shannon & Co., for brush, at \$2.60, and stone, at \$5 per cubic yard, '83, 1092.

1884. A. M. Shannon & Co., for brush, at \$2.60, and stone, at \$4.40 per cubic yard, '85, 1466.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 149; '81, 202; '82, 199; '83, 204; '84, 219; '85, 229; '86, 226; '87, 191.

BOARD OF ENGINEERS.

Convened by S. O. No. 63, Chief of Engineers, 1879, '80, 1254. (See Projects.)

ENGINEERS IN CHARGE.

Major S. M. Mansfield, 1880-'86. Reports, '80, 1245; '81, 1358; '82, 1469; '83, 1091; '84, 1312; '85, 1464; '86, 1330.

Maj. O. H. Ernst, 1886-'— . Report, '87, 1431.

ASSISTANTS.

T. S. Sedgwick. Report, '80, 1247.

W. L. Webb. Report, '82, 1472.

Operations.

1879-'80. Preliminary work in progress, '80, 1246.

1880-'81. Work done by hired labor and open market purchase; construction of groin jetties for protection of Mustang Island and the south channel jetty, '81, 202, 1361.

1881-'82. Construction of jetties by hired labor, '82, 1469; successful action of work done, '82, 199, 1470, 1474.

1882-'83. Extension of south jetty, by contract, 1,200 linear feet, by the use of 15,476 cubic yards brush and 3,474 tons of stone, '83, 1092.

1883-'84. Extension of jetty, by contract, to length of 3,900 linear feet; 10,686 cubic yards brush and 2,940 cubic yards stone used; channel 10½ feet deep at mean low water obtained over the bar, '84, 219, 1314.

1884-'85. Extension of jetty, by contract, seaward, and raising height of same by application of 23,017 cubic yards of brush mattresses and 4,626 tons of stone; building superstructure, by hired labor, over work previously completed; channel 11 feet at mean low water obtained over the bar, '85, 1466.

1885-'86. By hired labor, repairs made to outer end of south jetty, and trees planted on Saint Joseph's Island, '86, 1332.

1886-'87. Protective works in progress, '87, 1432.

Physical Characteristics.

Described, '80, 1254; '81, 1360.

Rate of movement of bar, '87, 1431.

Private and Corporate Work.

\$10,000 subscribed by local interests in 1883 to carry on the work, '84, 1313; '87, 1432.

Projects.

By Board of Engineers, 1879, for the formation and maintenance of a 12-foot channel at mean low water over the bar, by the extension of the north jetty from the end of Saint Joseph's Island and the south jetty from the end of Mustang Island, and the construction of groins in conjunction with beach protection for the head of Mustang Island to and beyond Turtle Cove; estimated cost of jetties, groins, etc., \$759,185. The improvement of the interior channel from the Pass up to Rockport and Corpus Christi to be by dredging; estimated cost of (by Maj. Howell), \$441,537.75, '80, 1247, 1254; '81, 1363; '85, 1465; '86, 1330 (Cols. Tower and Newton and Lieut. Col. Gillmore); '80, 1271.

In 1887, the work designed and partially executed having partially failed in obtaining the desired result at the Pass, Maj. Ernst proposed to abandon so much of the south jetty as curves northward, and by an easy change in direction to the southward to lead the jetty by the shortest line to deep water; the north jetty to be placed parallel to the outer end of the south jetty. For the protection of Mustang Island it was proposed to riprap its slope from high-water mark to bottom of the channel. The works proposed were expected to secure a channel at least 20 feet deep. Cost of revised project, \$2,052,543.72, '87, 1432.

Surveys.

Made, '80, 1258, 1264; '82, 1470; '83, 1092; '85, 1466.

Survey, 1883, by H. C. Ripley and W. L. Webb, '82, 1470.

MAPS.

'85, 1466.

Location of jetties, '87, 1432.

ARCHER'S HOPE RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 53.)

Appropriations.

1881..... \$5,000, '81, 990,
 1882..... 5,000, '82, 842.

Commerce.

Unimportant, '85, 1034.

Contracts.

1882. G. W. Ferris, for dredging, at 37½ cents per cubic yard, '82, 1075.
 1883. J. Caler & Son, dredging, at 27½ cents per cubic yard, '83, 841.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 159; '82, 155; '83, 161; '84, 165; '85, 157; '86, 152; '87, 117.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'81. Report, '80, 906.

Capt. J. Mercur, 1881-'84. Reports, '81, 969; '82, 1074; '83, 841.

Capt. F. A. Hinman, 1884-'—. Reports, '84, 1031; '85, 1034; '86, 962; '87, 977.

ASSISTANTS.

J. M. Wolbrecht. Report, '80, 907.

G. H. Elliott. Report, '82, 1075.

Operations.

1881-'82. 12,283 cubic yards removed by dredging; no material advantage to commerce resulting from work done, '82, 1075.

1882-'83. 16,254 cubic yards removed at mouth of river by dredging; limited extent of work renders its present value to commerce small, '83, 841.

1883-'87. No operations, '84, 1031; '85, 1034; '86, 962; '87, 977.

Physical Characteristics.

Described, '80, 906.

Projects.

By Captain Phillips, 1880, for the formation of a channel by dredging, not less than 50 feet wide and 6 feet deep, extending from the mouth to Williamsburgh, a distance of 5 miles, at an estimated cost of \$19,400.70, '80, 907; '85, 157; '87, 117.

Surveys.

By J. M. Wolbrecht, '80, 907.

ARKANSAS RIVER, ARK.

The appropriations for this river have been for the following subdivisions, viz:

Arkansas River, removing snags, etc., 1880-'86	\$315,875
Arkansas River, above Fort Smith, 1876-'86	153,000
Arkansas River, at Fort Smith, 1884-'86	18,000
Arkansas River, at Pine Bluff, 1880-'86	131,500
Arkansas River, from Little Rock to mouth, 1884.....	19,000
Arkansas River, for removing obstructions, 1888.....	25,000
Arkansas River, Ark, 1888.....	150,000

ARKANSAS RIVER, ABOVE FORT SMITH, ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 53.)

Appropriations.

1876 to '79..... \$40,000
 1880..... 15,000, '80, 1467.
 1881..... 24,000, '81, 1510.
 1882..... 20,000, '82, 1169.
 1886..... 54,000, '87, 1510.

Total 153,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 168; '81, 215; '82, 213; '83, 221; '84, 229, 232; '85, 245, 251; '86, 244; '87, 205, 1522.

ARKANSAS RIVER, ABOVE FORT SMITH, ARK.—Continued.**Engineers—Continued.****BOARD OF ENGINEERS.**

Convened at New York March, 1887, to consider the improvement of the Arkansas River. Report, '87, 1523, 1527.

(Cols. Casey and Abbot, Lieut. Cols. Comstock and McFarland.)

ENGINEERS IN CHARGE.

Maj. C. R. Suter, 1877-'81. Reports, '80, 1466; '81, 1660.

Capt. T. H. Handbury, 1881-'83. Reports, '81, 1508; '82, 1576; '83, 1168.

Maj. M. B. Adams, 1883-'84. Reports, '84, 1397, 1399, 1405.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1561, 1611; '86, 1391; '87, 1510, 1519, 1520.

Operations. (All operations by hired labor.)

1879-'80. Repair of dike at Fort Smith, '80, 1467.

1880-'81. Construction of snag-boat, '81, 1509.

1881-'82. Operations of snag-boat between mouth of Grand River and Fort Smith, '82, 1577. Repairs to dike at Fort Smith, '82, 1578.

1882-'83. 1,047 snags and trees and 20 piles of drift removed between mouth of Grand River and Fort Smith, '83, 1169.

1883-'84. 2,890 snags and trees and 2 drift-piles removed, '84, 1399. Survey in progress between Wichita and Fort Gibson, '84, 1405.

1884-'85. 1,399 snags and trees removed, '85, 1562. Survey above Fort Gibson in progress, '85, 1611.

1885-'86. Survey above Fort Gibson completed, '86, 1391.

1886-'87. Dike construction at Dardanelle; commencement of operations below Little Rock under project of 1886, '87, 1512, 1519.

Physical Characteristics.

Erosion of river bank in front of Fort Smith and bar formation at Van Buren, '84, 1397.

Private and Corporate Work.

Construction of 3 jetties by the Oil and Compress Company at Fort Smith, '84, 1397.

Projects.

By Maj. Suter, 1879, for an improvement between Fort Smith and Wichita Bar by removal of snags, rock, and other obstructions between the above limits; estimated cost, \$100,000, '79, 1081, 1088; '81, 215.

By Capt. Taber, 1885, for the permanent improvement of the river from Little Rock to its mouth, contemplating a channel at least 200 feet wide and 6 feet deep at low water, by the contraction and regulation of the channel; estimated cost, \$2,538,544, '85, 1603; '87, 1524.

Surveys.

1884. Survey from Wichita, Kans., to Fort Gibson, Ind. T., '84, 232; '85, 1611.

ARKANSAS RIVER—Removing Snags and Wrecks from.**Appropriations.**

1880. For removing snags and wrecks from Arkansas, Mississippi, and Missouri rivers. \$200,000, '80, 1404.

1881..... 25,000, '81, 1501.

1882..... 35,000, '82, 1574.

1884..... 36,000, '84, 228.

1886..... 19,875, '86, 1373.

Total 315,875

1888..... 25,000, act of August 11, 1888.

Commerce.

Justification of improvement, '84, 1391; '86, 1374, 1390; '87, 1508.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 162; '81, 213; '82, 211; '83, 219; '84, 227; '85, 244; '86, 238; '87, 204.

ENGINEERS IN CHARGE.

Maj. C. B. Suter, 1880-'81. Report, '80, 1401.

Capt. T. H. Handbury, 1881-'83. Reports, '81, 1499; '82, 1571; '83, 1165.

Maj. M. B. Adams, 1883-'84. Report, '84, 1390.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1558; '86, 1371; '87, 1506.

ARKANSAS RIVER—Removing Snags and Wrecks from—C'd.**Operations.** (All operations by hired labor.)

1879-'80. 500 miles of river between mouth and Trustee Bend worked over; 1,238, snags and trees and 19 drift-piles removed, '80, 1403.

1880-'81. 2,377 snags and trees and 44 drift-piles removed between mouth and Webber's Falls, '81, 1500.

1881-'82. 4,436 snags and trees and 18 drift-piles removed between mouth and Fort Smith, '82, 1572.

1882-'83. 1,267 snags and 12 drift-piles removed between mouth and Fort Smith '83, 1166.

1883-'84. 654 snags and 9 drift-piles removed, '84, 1390.

1884-'85. 15,178 snags and trees and 19 drift-piles removed between mouth and Fort Gibson, '85, 1559.

1885-'86. Repair of snag-boat Wichita, '86, 1372.

1886-'87. 1,385 snags removed, '87, 1508.

Surveys.

From Little Rock to mouth, '85, 1601.

ARKANSAS RIVER, AT FORT SMITH, ARK.—IMPROVEMENT OF.**Appropriations.**

1884..... \$5,000, '85, 1563.

1886..... 13,000, '87, 205.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 245; '87, 205.

ENGINEERS IN CHARGE.

Maj. M. B. Adams, 1884. Report, '84, 1397.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1563; '87, 1511, 1518.

ASSISTANT.

F. D. Lewis, '85, 1564.

Operations.

History of previous operations, '85, 1563.

1884-'85. Extension of jetty previously built by private enterprise, '85, 1564. No further work required, '85, 1563.

1886-'87. 1,300 linear feet of permeable dike completed, '87, 1511.

Physical Characteristics.

Erosion of river bank at Fort Smith, '84, 1397.

Projects.

In 1878 Maj. Suter proposed, for the improvement of the river at Fort Smith, a brush and stone dike 1,100 feet long, extending from the left bank and near the mouth of Poteau River; this work was completed in 1879 at a cost of \$19,695, '78, 658; '79, 1082; '85, 1563.

In 1884 Maj. Adams proposed repairing a few small dikes built by private enterprise, '84, 1397; '85, 1563.

ARKANSAS RIVER AT PINE BLUFF, ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 54.)

Appropriations.

1880..... \$25,000, '80, 1467.

1881..... 23,000, '81, 1503.

1882..... 20,000, '82, 1576.

1884..... 55,500, '84, 229.

1886..... 8,000, '86, 1376.

Total 131,500

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 168, 169; '81, 214; '82, 212; '83, 220; '84, 229, 1394; '85, 245; '86, 238; '87, 205.

ARKANSAS RIVER AT PINE BLUFF, ARK.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. C. R. Suter, 1879-'81. Report, '80, 1467, 1468.

Capt. T. H. Handbury, 1881-'83. Reports, '81, 1502; '82, 1575; '83, 1168.

Maj. M. B. Adams, 1883-'84. Report, '84, 1393, 1395.

Capt. H. S. Taber, 1884-'— . Reports, '85, 1564, 1576; '86, 1376; '87, 1511, 1515, 1518.

ASSISTANTS.

Capt. T. H. Handbury. Report, '80, 1468.

W. H. Byram. Report, '81, 1504.

E. F. Officer. Report, '85, 1571.

T. P. Adams. Report, '85, 1580.

Operations. (All operations by hired labor.)

1880-'81. 7,600 linear feet of bank revetted in front of city and at Yell's Bend; 1,110 linear feet of wire curtain dike placed in channel $2\frac{1}{2}$ miles above city, '81, 1502.

Details of work done, '81, 1505.

1881-'82. 3,000 linear feet of bank revetted at Yell's Bend. Details and cost of work done, '82, 1576.

1882-'83. 3,000 linear feet of bank regraded, 2,400 feet of low-water and 1,000 feet of high-water protection placed, '83, 1168.

1883-'84. No operations for lack of funds, '84, 1393. Destruction by floods of all previous works of improvement, '84, 1396; '85, 1565.

1884-'85. Construction of two deflecting dikes, '85, 1567. Dikes described, '85, 1571, 1581.

1885-'86. Construction of two short deflecting hurdle dikes in front of Pine Bluff City, '86, 1375.

1886-'87. Extension of dike No. 1, '87, 1516. Successful results attained, '87, 1517.

Physical Characteristics.

Danger from cut-off at Pine Bluff, '80, 1468. Erosion of bank in vicinity of, '80, 1469; '84, 1395; '85, 1565. Formation of river banks, '84, 1395. Effect of freshet in 1884, '85, 1565, 1567.

Plans.

By Maj. Adams, 1884, after failure of previous project, to protect Pine Bluff City by (1) formation of cut-off 3 miles from the city, at estimated cost of \$37,732; (2) by mattress protection, at estimated cost of \$45,000; (3) by pile jetties 1,500 feet long, at estimated cost of \$55,000, '84, 1396.

Projects.

By Maj. Suter, 1880, for the improvement of the river in the vicinity of Pine Bluff, by the protection of river bank from erosion, the rectification of the river just above, and the prevention of a cut-off across the peninsula opposite Pine Bluff; estimated cost, \$100,000, '80, 1468, 1470. Failure of project, '84, 1395; '85, 1565; '87, 1515.

In 1884, to protect the threatened destruction of the city front, two deflecting dikes of piles, brush, and sand boxes were built; the upper dike 1,520 feet and the lower dike 251 feet long; the works were entirely successful, and cost about \$49,000, '85, 1567, 1571, 1581. Successful results attained, '87, 1517.

Surveys.

Ordered by act of March 3, 1879, '80, 169. Made under direction of Maj. Suter 1879, '80, 1468.

MAPS.

'81, 1504; '85, 1570.

**ARKANSAS RIVER, FROM LITTLE ROCK TO ITS MOUTH.—
SURVEY OF.****Appropriations.**

1884..... \$19,000, '85, 1603.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 251; '86, 244; '87, 206.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1601; '86, 1399; '87, 1528.

ASSISTANT.

C. E. Taft. Report, '85, 1604.

Operations.

1884-'85. Field work completed, '85, 1601.

1885-'86. Progress on maps, '86, 1389.

1886-'87. Completion of survey, '87, 1529.

ARKANSAS RIVER, FROM LITTLE ROCK TO ITS MOUTH— Continued.

Physical Characteristics.

Described, '85, 1605.

Plans.

By Capt. Taber, 1886, for the improvement of the river from Little Rock to the mouth, so as to obtain a channel 200 feet wide and 6 feet deep at low water, by the contraction of the channel, with primary and secondary hurdless; estimated cost, \$2,538,544, '85, 1603.

(See Projects, Arkansas River, Ark.)

Surveys.

From Little Rock to its mouth, '85, 1601; '86, 1389.

AROOSTOOK RIVER, ME.—SURVEY OF.

(Continued from Vol. I, p. 54.)

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 72. (Printed in House Ex. Doc., No. 84, 43d Cong., 1st sess.)

ARROW ROCK, MO.—SURVEY AT

(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)

ARTHUR KILL, NEW YORK AND NEW JERSEY.

The act of August 11, 1888, appropriated \$10,000 for dredging and straightening the channel near the Staten Island Bridge, and removing the point of land west-
erly of the same.

ASHLAND HARBOR, WIS.—EXAMINATION AND SURVEY OF.

(Continued from Vol. I, p. 55.)

Appropriations.

1886..... \$22,500, '86, 449.

1888..... 60,000, act of August 11, 1888.

Commerce.

Statistics, '85, 2010. Necessity for breakwater-protection to wharves and piers, '85, 2011.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 206; '85, 307; '86, 301; '87, 256, 1960.

BOARD OF ENGINEERS.

Constituted by S. O. No. 35, to report upon project for improvement of Ashland Harbor. Report, '87, 1961.

(Maj. Allen, Capt. Lockwood, and Capt. Marshall.)

ENGINEERS IN CHARGE.

Lieut. Col. Robert, '80, 1929.

Lieut. Col. Barlow, 1884. Reports, '85, 2010, 2012; '86, 1674.

Capt. C. E. L. B. Davis, 1887— Report, '87, 1957.

ASSISTANTS.

L. Y. Schermerhorn. Report, '80, 1930.

H. N. Babcock. Report, '86, 1676.

Physical Characteristics.

Described, '80, 1930; '86, 1677.

ASHLAND HARBOR, WIS.—Continued.**Plans.**

By Lieut. Col. Barlow, 1885, for the construction of a pile and slab breakwater, about 8,000 feet in length, located about 2 miles northeast of the present ore dock, at an estimated cost of \$132,377, and the removal, by dredging to a depth of 12 feet, the shoal in front of Mueller & Ritchie's wharf, at an estimated cost of \$10,000, '85, 2013; '86, 1675.

Projects.

By the Board of Engineers, 1887, for improvement of Ashland Harbor by preservation of Chequannagon Point, and dredging to the necessary distance in front of the wharves to provide for vessels drawing 16 feet of water; no estimate of cost presented, '87, 1966.

Surveys.

1885. By H. N. Babcock, '86, 1676.

ASHLEY RIVER, S. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 55.)

Appropriations.

1880.....	\$1,000, '80, 933.
1881.....	1,500, '81, 1068.
1884.....	2,000, '84, 1098.
1886.....	1,000, '86, 1062.

Total..... 5,500

List of appropriations, '87, 1142.

Contracts.

1882. Charleston Dredging Company, for dredging, at 17 cents per cubic yard, '82, 1140.

1885. Ross & Sanford, dredging, at 20 cents per cubic yard, '86, 1082.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 127; '81, 170; '82, 166; '83, 175; '84, 182; '85, 180; '86, 179; '87, 142.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1873-'—. Reports, '80, 932; '81, 1067; '82, 1138; '83, 892; '84, 1097; '85, 1188; '86, 1080; '87, 1141.

ASSISTANTS.

Capt. B. D. Greene. Reports, '81, 1068; '82, 1140.

Lieut. F. V. Abbot. Report, '85, 1190.

Operations.

1881-'82. No previous operations; 13,558 cubic yards dredged, opening a channel across the shoal at the Wando Phosphate Works 100 feet wide and 11 feet deep, '82, 1139.

1882-'84. No operations for lack of funds, '83, 892; '84, 1097.

1884-'85. No operations from excessive bids made for dredging, '85, 1189.

1885-'86. 8,566 cubic yards dredged from shoal near Stono Phosphate Island in the formation of a channel 210 feet wide and 11 feet deep at mean low water, '86, 1081.

1886-'87. No operations; available funds held until conditions of improved channel requires further expenditure, '87, 142, 1141.

Projects.

By Lieut. Col. Gillmore, 1873, for the formation of a dredged channel 11 feet deep at mean low water across shoals of Accabee and the Wando Phosphate Works, at an estimated cost of \$5,000, '73, 756; '86, 179; '87, 1141.

ASHTABULA HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 55.)

Appropriations.

1886-'79.....	\$290,710.86, '79, 1702.
1880.....	20,000.00, '80, 2164.
1881.....	20,000.00, '81, 2325.

ASHTABULA HARBOR, OHIO—Continued.**Appropriations—Continued.**

1882.....	20,000.00, '82, 2411.
1884.....	22,500.00, '84, 2117.
1886.....	30,000.00, '86, 1872.
Total.....	403,210.86
1888.....	25,000.00, act of August 11, 1888.

Contracts.

1878. K. McKenzie, for crib construction, '80, 2166.
 1879. Cleveland, Brown & Co., for iron, '80, 2166.
 1879. Hemmenway & Hayes, for crib construction, '80, 2166; contract annulled as to principals and continued by bondsmen, '81, 2324.
 1880. J. Barnett, for iron; G. W. and A. T. McKenzie, for materials and work; J. Caldwell, for materials and work; F. Wilson, for iron; D. B. McCoy, for dredging, at 20 cents per cubic yard, '81, 2324, 2327.
 1883. G. B. Raasher, for dredging, at 30 cents per cubic yard, '84, 2115.
 1884. McKenzie & Barrett, for dredging and pier construction, '85, 2244.
 1886. L. P. & J. A. Smith, for dredging and pier construction, '85, 2244.
 1887. Carlin, Stickney & Cram, for rock removal and dredging, '87, 2331.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 227; '81, 311; '82, 306; '83, 314; '84, 318; '85, 342; '86, 337; '87, 302.

ENGINEERS IN CHARGE.

- Lieut. Col. J. M. Wilson, 1878-'82. Reports, '80, 2155; '81, 2322; '82, 2409.
 Maj. M. B. Adams, 1882-'83. Report, '83, 1917.
 Capt. E. Maguire, 1883-'85. Report, '84, 2113.
 Maj. L. C. Overman, 1885-'—. Reports, '85, 2240; '86, 1871; '87, 2327.

Operations.

- History of past operations from 1826, '80, 2155; '83, 1920; '84, 2118.
 1879-'80. 120 linear feet of substructure and 202 linear feet of superstructure built; extensive repairs to west and minor repairs to east piers; 7,969 cubic yards dredged from shoal at entrance to harbor, '80, 2162, resulting in the formation of a channel depth between the piers of from 14½ to 16 feet, with a channel of entrance from 15 to 17 feet deep, '80, 227.
 1880-'81. East and west piers each extended 200 linear feet; 4,433 cubic yards material dredged from bar at entrance to piers, resulting in the formation of a channel from 15 to 17 feet deep, '81, 2323, 2324.
 1881-'82. West pier extended 403 feet and east pier 121 feet; 5,447 cubic yards material removed from channel and repairs made to piers. Advance of outer bar proportionate to pier extension, '82, 2410.
 1882-'83. 7 crib substructures built and ready to place in position, '83, 1918.
 1883-'84. Extension of west pier shoreward 285 linear feet; 2,968 cubic yards dredged from channel; repair of east pier by hired labor, '84, 2114.
 1884-'85. Extension of west pier shoreward 282½ linear feet; repairs to east pier and to shore protection at inner end of west pier; 17,173 cubic yards of material dredged from the channel and bank in rear of old pier; a channel 15½ feet deep was obtained from deep water outside, '85, 2240.
 1885-'86. 400 linear feet of shore end of west pier removed and 380 linear feet of same partially revetted; slight repairs by hired labor to shore protection, '86, 337, 1871.
 1886-'87. 8,483 cubic yards of sand dredged from bar and channel; repair of old piers; rock removal from channel commenced, '87, 2328.

Projects.

- By Lieut. Col. J. M. Wilson, 1880, for the further extension of the piers to the 16-foot curve, with the removal of 1,100 linear feet of old west pier, revetting the river bank, and the removal by dredging of 20,000 cubic yards of material, at an estimated cost of \$88,000, '80, 2163. In 1882 Lieut. Col. Wilson estimates that \$62,000 will be required, in addition to the \$60,000 appropriated since 1880, to complete the work, '82, 2410. Lieut. Col. Wilson does not deem it possible to maintain a depth at entrance to pier of 16 feet without continual dredging, '82, 2411.

In 1883 Maj. Adams increases the foregoing estimate to \$91,800, '83, 1918.

In 1884 Maj. Maguire increases previous estimate to \$102,750, '84, 2117; '85, 342.

Surveys.**MAPS.**

- '81, 2324; '84, 2116.

ASSATEAQUE BAY, DEL.—(See CHINQUOTEAQUE BAY TO DELAWARE BAY.)

ATCHAFALAYA RIVER, LA.—EXAMINATION AND SURVEY OF.

(Continued from Vol. I, p. 57.)

Commerce.

Tributary to the improvement, '85, 1432, 1434, 1439.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 146; '81, 197; '82, 193; '84, 216; '85, 226.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1880-'82. Report, '82, 1394.

Maj. H. Stickney, 1882-'86. Reports, '82, 1393; '84, 1285.

Capt. T. Turtle, 1885. Report, '85, 1436.

Maj. W. H. Heuer, 1885-'— . Report, '85, 1432

ASSISTANT.

Lieut. O. T. Crosby. Report, '85, 1436.

Physical Characteristics.

Described, '82, 1395.

Private and Corporate Work.

The river formerly cleared of logs by State of Louisiana, '82, 1396.

Projects.

In 1882 Maj. Stickney considered that the improvement of the Atchafalaya River is so intimately connected with the Mississippi that no recommendations can be made until the Mississippi River Commission shall have taken action, '82, 1410. To form a channel through the shoal areas at its mouth in the Gulf of Mexico would be expensive and for the benefit of comparatively little commerce; the locality not yet considered worthy of improvement, nor the work a public necessity, '84, 1285.

In 1884 Capt. Turtle considered the river worthy of improvement and submits an estimate of \$20,000 for provisional work, '85, 1433.

In 1885 Maj. Heuer considered that no plan of improvement was worth considering until the Mississippi River Commission shall have taken action, '85, 1435.

Surveys.

1880. Under direction of Maj. Howell, from Berwick's Bay to mouth of Red River, '82, 1394.

1885. By Capt. Turtle, from Berwick's Bay to Red River, '85, 1432.

ATCHISON, KANS.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)

ATLANTIC CITY HARBOR, N. J.—SURVEY OF.

Appropriations.

1886..... \$5,000, '87, 814.

Commerce.

Necessity for harbor of refuge on the New Jersey coast, '81, 831; '85, 862; '87, 816.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 98; '81, 129; '85, 127; '87, 85.

BOARD OF ENGINEERS.

Constituted by S. O., No. 141, Chief of Engineers, 1886, to examine and report upon a harbor of refuge at Atlantic City. Report, '87, 816.

(Lieut. Cols. Comstock, Robert, and McFarland.)

ENGINEERS IN CHARGE.

Capt. W. Ludlow. Report, '81, 831.

Maj. W. H. Heuer. Report, '85, 862.

Lieut. Col. H. M. Robert, 1886-'—. Report, '87, 814.

ASSISTANTS.

G. Daubeney. Report, '81, 832.

L. d'Auria. Report, '87, 819.

ATLANTIC CITY HARBOR, N. J.—Continued.**Physical Characteristics.**

Described at Absecom Inlet, '81, 831; '85, 863; '87, 817.

Tidal and current observations, '81, 833; '87, 815, 819.

Plans.

By Maj. Heuer, 1884, for an improved entrance to the deep water inside of Absecom Inlet by means of a south jetty, starting from the beach below the light-house, and a north jetty from Brigantine Beach, converging to a width of entrance of about one-fourth of a mile in water 18 feet deep; estimated cost of jetties, \$960,000; the work not considered a public necessity, '85, 862-864.

By Board of Engineers, 1887, for the formation of a harbor of refuge in the inner harbor by the construction of a channel of entrance across the outer bar, having a low-water depth of 20 feet; the channel to be attained by the construction of two converging jetties of random stone, with a superstructure of concrete above the plane of low water; estimated cost of jetties, \$3,000,000. If the entire amount of material to be removed from channel between the jetties should require to be dredged, the cost of the improvement would be increased by \$600,000, '87, 817, 818.

Surveys.

Ordered by act of March 3, 1879, '80, 97. Made under direction of Capt. Ludlow, 1880, '81, 831.

Ordered by act of August 5, 1888. Made under direction of a Board of Engineers, 1876, '87, 815.

MAPS.

'87, 818.

AUCILLA AND WACISSA RIVERS, FLA.—EXAMINATION OF.**Commerce.**

None to be benefited by improvement, '80, 1302.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell, 1880. Report, '82, 1302.

ASSISTANT.

P. Robinson. Report, '82, 1303.

Physical Characteristics.

Natural bridge across river, '82, 1302.

Plans.

In 1881 Capt. Damrell considered that the removal of obstructing logs could be accomplished for \$500 if done in connection with the improvement of the Aucilla River, '82, 1303.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Capt. Damrell, '82, 1302.

AU SABLE RIVER AND HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 58.)

Appropriations.

1867-'78	\$95,970, '79, 169, 1657.
1880	7,000, '80, 2039.
1881	6,000, '81, 2247.
1882	5,000, '82, 2331.

Total 113,970

Statement of previous appropriations, '80, 2039.

Contracts.

1879. J. E. Worden, for construction of revetments, '80, 2037, 2039.

1880. C. Southerland, for pile and slab revetment, '81, 2245.

1881. Carlin, Stickney & Crane, for dredging, at 26 cents per cubic yard, '81, 2247.

AU SABLE RIVER AND HARBOR, MICH.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 220; '81, 298; '82, 292; '83, 302; '84, 304; '85, 327; '86, 321; '87, 298.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1878-'83. Reports, '80, 2037; '81, 2245; '82, 2330.

Maj. F. N. Farquhar, 1883, '83, 1835.

Lieut. Col. O. M. Poe, 1883—'. Reports, '83, 1854; '84, 2040; '85, 2130, 2132; '86, 1925; '87, 2250.

ASSISTANT.

B. H. Muehle. Report, '83, 1857.

Operations.

History of past operations, '85, 2132.

1879-'80. Construction of revetment along northeast bank of river, '80, 2038.

1880-'81. Revetment from the Oscoda Bridge to United States piers completed, '81, 2245. Construction by hired labor of training-wall across bar at entrance to mouth of harbor, '81, 2246.

1881-'82. Extension of south pier by hired labor and dredging by contract of 3,000 cubic yards of sand from bar at mouth of harbor, '82, 2330.

1882-'83. Slight repairs by hired labor, '83, 1854.

1883-'87. No operations, '84, 2040; '85, 227; '86, 322; '87, 2250.

Projects.

By Maj. Reynolds, 1886, for the extension of the piers to 12-foot curve and dredging for the formation of a channel to that depth; estimated cost, \$114,754, '66, iv, 77; '85, 2132.

Modified in 1867 by Col. Cram, to provide a channel 10 feet deep, in place of 12; estimated cost, \$82,893, '67, 147; '85, 2133. After the expenditure of appropriations aggregating \$95,970, Maj. Harwood, in 1879, proposed at an estimated cost of \$35,000 for the completion of the improvement, the formation of a channel 10 feet deep and 100 feet wide, extending from deep water in the lake to the State Street Bridge in Au Sable (S. Ex. Doc. 79, 45th Cong., 3d sess.), '79, 1657. Estimated in 1883 by Maj. Farquhar, \$12,121, '83, 1857.

In 1885 Lieut. Col. Poe considered that the formation of the bar at entrance to the harbor precluded its improvement at a cost commensurate with the advantages to be gained, '85, 2130; '86, 322. Expenditures have resulted in a depth of 4 feet on the bar and 8 feet in the channel from bar to Oscoda Bridge, '85, 2137.

Surveys.

Under direction of Maj. Harwood, 1882, '82, 2330.

Under direction of Maj. Farquhar, 1883, '83, 1854.

MAPS.

'82, 2330; '83, 1856.

AUX BECS SCIES, MICH.—(See FRANKFORD HARBOR, Mich.)**BACK BAY AT HANDSBOROUGH, MISS.—(See HANDSBOROUGH, Miss.)****BAKER'S AND SHOALWATER BAYS, WASH.—Canal between—SURVEY FOR.**

(Continued from Vol. I, p. 513.)

Commerce.

Necessities of commerce, '87, 2727.

Engineers.**CHIEF OF ENGINEERS.**

Report, '81, 332; '82, 324.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '82, 2724.

ASSISTANT.

R. A. Habersham, '82, 2725.

BAKER'S AND SHOALWATER BAYS, WASH.—Continued.**Physical Characteristics.**

Description of Baker's and Shoalwater Bays, '82, 2724.

Plans.

By Capt. Powell, 1881, for a water communication via Johnson's and Holman's lakes and Tarlet Slough, in which the canal part is to be 40 feet wide at bottom; estimated cost, \$512,520, '82, 2725, 2727.

Surveys.

Previous surveys, '82, 2725.

Ordered by act of March 3, 1881. Made, 1881, under direction of Capt. Powell, '82, 2724.

BALDWIN RIVER, N. Y.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 114.

ENGINEER IN CHARGE.

Maj. G. L. Gillespie. Report, '85, 781.

Physical Characteristics.

Locality described, '85, 781.

Plans.

In 1884 Maj. Gillespie considered that the desired improvement would cost \$20,000, but that there was no present or prospective commerce to justify the expenditure, '85, 789.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Gillespie, '85, 789.

BALTIMORE HARBOR, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 60.)

Appropriations.

1836-'79	\$1, 171, 830
1880	100, 000, '80, 626.
1881	150, 000, '81, 863.
1882	450, 000, '82, 844.
1884	250, 000, '84, 895.
1886	150, 000, '86, 874.

Total 2, 271, 830

1888 300, 000, act of August 11, 1888.

Contracts.

1880. G. C. Fobes & Co., dredging, at 18 $\frac{1}{2}$ cents per cubic yard, '80, 626.

1881. American Dredging Company, dredging, at 10 $\frac{1}{2}$ cents per cubic yard, '81, 864.

1882. Morris & Cumings Dredging Company, at 16 cents per cubic yard, for removal of 2,500,000 cubic yards; Thomas Potter, 500,000 cubic yards, at 13 $\frac{1}{2}$ cents per cubic yard, '83, 671.

1884. Completion of contracts with American Dredging Company, Morris & Cumings Dredging Company, and Thomas Potter, by aggregate removal of 4,847,983 cubic yards, '84, 895.

1884. American Dredging Company, for removal of 1,500,000 cubic yards, at 15 cents per cubic yard; completed June 30, 1885, '85, 918.

1886. American Dredging Company, for dredging, at 13 cents per cubic yard, '87, 861.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 101; '81, 134; '82, 131; '83, 135; '84, 142; '85, 137; '86, 133; '87, 97, 101.

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1870—'. Reports, '80, 625; '81, 860; '82, 843; '83, 669; '84, 894; '85, 917; '86, 874; '87, 860, 880.

ASSISTANT.

W. H. Hutton, '85, 918.

BALTIMORE HARBOR, MD.—Continued.**Legislation.**

An act to protect the "Craighill Channel," '81, 833. Protection of aids to navigation, '82, 844.

Operations.

1879-'80. 431,000 cubic yards dredged, '80, 625.
 1880-'81. 181,930 cubic yards dredged, '81, 860.
 1881-'82. 709,725 cubic yards dredged, '82, 843.
 1882-'83. 2,554,861 cubic yards dredged, '84, 895.
 1883-'84. 1,583,397 cubic yards dredged, '84, 895.
 1884-'85. 1,715,247 cubic yards dredged, '85, 918.
 1885-'86. No operations from lack of funds, '86, 874.
 1886-'87. 1,111,317 cubic yards dredged, '87, 860.

Private and Corporate Work.

The city of Baltimore and State of Maryland have contributed up to 1885 \$584,000 towards the improvement, '85, 138.

Projects.

From 1836 to 1838, inclusive, \$55,000 was appropriated for Baltimore Harbor, '66, iii, 36.

In 1852 the project originated for improving the channels at approach from deep water in Chesapeake Bay, and was inaugurated under the joint action of the Government and State of Maryland in the improvement of the Brewerton Channel to a width of 150 feet and a depth of 22 feet, '67, 420; '70, 418; '74, ii, 19; '79, 492.

In 1866 Maj. Craighill proposed an alteration in the direction of a part of the channel, with a widening of the channels to 200 feet, '66, iv, 233, 234; '67, 42, 417, 420, 422.

In 1872 the project was revised to provide for channels 24 feet deep at mean low water, and from 250 to 400 feet wide, '72, 67; '73, 761; '74, 221.

In 1881 Lieut. Col. Craighill proposed the deepening of the channels to 27 feet at mean low water, together with the formation of a cut-off between the lower part of the Brewerton and the upper part of the Craighill channels, '81, 861. This work was practically accomplished in 1886, '86, 874.

The total amount appropriated from 1852 to 1886, inclusive, was \$2,216,830.

In 1887 Col. Craighill proposed the widening of the channels to 600 feet, at an estimated cost of \$1,300,000, '87, 860, 881.

Surveys.

1881. By J. L. Seager, '81, 862.

1885. Survey of channels, '86, 874.

1886. Survey of channel with a view of widening it to 600 feet ordered by act of August 5, 1886. Made under direction of Col. Craighill, '87, 880.

BANGOR HARBOR AND PENOBSCOT RIVER, ME.—IMPROVEMENT OF.

(See also PENOBSCOT RIVER.)

Appropriations.

1884..... \$20,000, '85, 465.
 1886..... 15,000, '87, 442.
 1888..... 50,000, act of August 11, 1888.

Commerce.

Commercial necessity for increased harbor facilities, '84, 477.

Contracts.

1885. Moore & Wright, dredging, at 36 cents per cubic yard, '86, 531.
 1887. Moore & Wright, dredging, at 23 cents, and rock removal, at \$10 per cubic yard, '87, 443.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 73; '85, 55; '86, 55; '87, 16.

ENGINEERS IN CHARGE.

Col. C. E. Blunt, 1884-'86. Reports, '84, 475, 476; '85, 464.

Maj. J. A. Smith, 1886-'— . Reports, '86, 530; '87, 442.

Operations.

For operations previous to 1884 see Penobscot River, Me.

1885-'86. 40,000 cubic yards dredged from channel in Bangor Harbor, '86, 531.

1886-'87. No operations, '87, 443.

BANGOR HARBOR AND PENOBSCOT RIVER, ME.—Continued.**Projects.**

For projects previous to 1884 see Penobscot River, Me.

The project of 1884 proposed, by dredging, the widening of the channel opposite Bangor to a width of 300 feet, with a low-water depth of 11 feet; also widening, straightening, and deepening the channel near Crosby's Narrows; estimated cost, \$75,000, '84, 477; '86, 531.

Surveys.

Ordered by act of March 2, 1882. Made under direction of Col. Thom, 1883, '84, 476. Examination from Bangor to Bucksport Narrows; ordered by act of August 5, 1886, '87, 22.

BARATARIA BAY, LA., FROM NEW ORLEANS TO GRAND PASS—SURVEY OF.**Commerce.**

Statistics, '81, 1313.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197.

ENGINEER IN CHARGE.

Maj. C. W. Howell, 1880. Report, '81, 1307.

Plans.

By Maj. Howell, 1881, for a 5-foot navigation from New Orleans to Barataria Bay, by removal of obstructions and dredging, at an estimated cost for route No. 1, \$78,486.87, or for route No. 2, \$108,158.32, '81, 1314.

Private and Corporate Work.

Three private canals on routes which are now used by commerce, '81, 1306, 1313; rate of tolls charged, '81, 1314.

Surveys.

Under direction of Capt. G. W. Hughes, '81, 1307.

1880. By H. S. Douglass, from New Orleans to Grand Pass, '81, 1307, 1308.

BAR HARBOR, ME., with a view to establishing a breakwater and deepening the channel between Rodick's and Mount Desert Islands.

[\$50,000 appropriated by act of August 11, 1883, for breakwater between Mount Desert and Porcupine Island.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 22.

ENGINEER IN CHARGE.

Maj. J. A. Smith, '87, 481.

Physical Characteristics.

Description, '87, 481.

Plans.

By Maj. Smith, for construction of riprap breakwater, with concrete superstructure, extending from Round Porcupine Island to Porcupine Dry Island, and thence to within 400 feet of the shore-line; estimated cost, \$500,000, '87, 484.

Surveys.

Examination and survey ordered by act of August 5, 1886. Made 1887 under direction of Maj. Smith, '87, 483.

MAPS.

'87, 483.

BAR LAKE, MICH. (See EMPIRE LAKE.)**BARREN RIVER, KY.—EXAMINATION OF.**

(See GREEN RIVER AND ITS TRIBUTARIES.)

BATH, ME.—IMPROVEMENT OF "GUT" OPPOSITE.

(Continued from Vol. I, p. 62.)

Appropriations.

1870-'78	\$33,500, '80, 333.
1880	7,000, '80, 335.
1881	5,000, '81, 68.
1888	75,000, act of August 11, 1888.
Statement of appropriations, '80, 333.	

Contracts.

1880. J. Andrews, for removing rock, at \$35 per cubic yard, '80, 484.
 1881. G. W. Townsend, for removing rock, at \$36 per cubic yard, '81, 485.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 65; '81, 67; '82, 67; '83, 62.

ENGINEERS IN CHARGE.

Col. G. Thom, 1867-'83. Reports, '80, 333; '81, 484; '82, 496.

Col. C. E. Blunt, 1883-'— Report, '83, 418.

Operations.

1879-'80. 186½ cubic yards rock removed from ledge; 11,800 cubic yards material dredged at shoal above upper Hell Gate; 1,200 tons of stone placed in jetty, '80, 334.

1880-'81. Removal of 120 cubic yards of rock, at \$36, '81, 485.

1881-'82. Removal of sunken ledges completed, '82, 497.

1882-'83. Removal of 57 cubic yards of rock. Improvement completed as originally projected, '83, 419.

Physical Characteristics.

Description of, '80, 333.

Projects.

By Col. Thom, 1870 and 1878, for the formation of a channel not less than 90 feet wide and from 11 to 12 feet deep at mean low water, by the removal of rock, '70, 81; '78, 197; '79, 253; '82, 67. Project completed in 1883 by the expenditure of \$45,500, '83, 62.

Surveys.

Examination at Bath, from Augusta to Perkins Island, ordered by act of August 5, 1886, '87, 22.

MAPS.

'80, 334.

BATTERY ISLAND, CHESAPEAKE BAY—RECONSTRUCTION AND PROTECTION OF WORKS AT.**Appropriations.**

1886

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 99.

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1887-'— Report, '87, 864.

Operations.

1886-'87. 620 linear feet of crib-work sunk by hired labor in repair to damaged portion of breakwater, '87, 865.

Project.

By W. F. Smith, 1886, for repairing injuries to existing piers and breakwater, and for riprap jetty construction; estimated cost, \$17,275, '87, 864.

BATTERY BEEF. (See EAST RIVER, N. Y.)**BAYADUCE (BAGADUCE) RIVER, ME.**

[Examination ordered by act of August 5, 1886, '87, 22; \$3,000 appropriated by act of August 11, 1888.]

BAYFIELD HARBOR, WIS.—EXAMINATION OF.

(Continued from Vol. I, p. 62.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 206.

ENGINEER IN CHARGE.

Maj. H. M. Robert. Report, '80, 1929.

ASSISTANT.

L. Y. Schermerhorn. Report, '80, 1929.

Plans.

Maj. Robert could not find anything requiring improvement, '80, 1929.

Surveys.

Ordered by act of March 3, 1879. Examination made under direction of Maj. Robert, '80, 1929.

BAYOU ANDRÉ, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197.

ENGINEER IN CHARGE.

Maj. C. W. Howell. Report, '81, 1305.

ASSISTANT.

H. S. Douglass. Report, '81, 1306.

Plans.

Maj. Howell in 1881 considers that there is no pressing need for the improvement of Bayou André, '81, 1305.

Surveys.

Ordered by act of June 14, 1880, '80, 146. Examination made under direction of Maj. Howell, '81, 1306.

BAYOU BARTHOLOMEW, ARK. AND LA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 62.)

Appropriations.

1881.....	\$8,000, '81, 1422.
1882.....	5,000, '82, 1559.
1884.....	5,000, '84, 1331.
1886.....	5,000, '86, 1353.

Total	23,000
1888.....	5,000, act of August 11, 1888.
Statement of appropriations, '87, 1461.	

Commerce.

Reduction in insurance due to improvement, '83, 1159.

Contracts.

1884. Emmick & Feith, for removal of obstructions, at \$75 per mile, '85, 1501.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 211, 213; '82, 208; '83, 217; '84, 222; '85, 235; '86, 231; '87, 196.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1880-'82. Reports, '81, 1422, 1453; '82, 1558.

Maj. A. M. Miller, 1882-'84. Reports, '83, 1158; '84, 1330.

Capt. E. Bergland, 1884-'86. Reports, '85, 1501, 1548; '86, 1353.

Capt. J. H. Willard, 1886-'— . Report, '87, 1459.

ASSISTANTS.

R. M. Spicer. Report, '83, 1159.

C. Quinn. Report, '85, 1549.

Operations.

1881-'82. Removal by hired labor of 9,954 trees and logs, 5 drift-piles, and 1 wreck, '82, 1558.

BAYOU BARTHOLOMEW, ARK. AND LA.—Continued.**Operations—Continued.**

- 1882-'83. Removal by hired labor of 4,341 trees, logs, and stumps, '83, 1159.
 1883-'84. No operations for lack of funds, '84, 1330.
 1884-'85. Removal by contract of 5,837 stumps, logs, and snags, 2 wrecks, 123 brush-piles, and 697 leaning trees; clearing 66½ miles of the bayou, '85, 1502.
 1885-'86. No operations for lack of funds, '86, 1353.
 1886-'87. 5,289 trees, logs, and snags removed, '87, 1460.

Plans.

Capt. Bergland, 1885, estimates \$20,000 as cost of removal of obstructions for a navigation of seven months in the year, but does not consider the bayou above its head of navigation at present worthy of improvement, '87, 1548.

Projects.

By Maj. W. H. H. Benyanrd, 1880, for the improvement of the bayou from Baxter Station to its mouth, a distance of 213 miles, by the removal of trees, logs, and snags; estimated cost, \$26,862, '81, 1455.

No permanent improvement can be effected, '85, 235.

Surveys.

Previous examinations and surveys, '81, 1454.

Examination made in 1884, '85, 1501.

Examination ordered from present head of navigation to Lincoln County line by act of July 5, 1884. Made, 1885, under direction of Capt. Bergland, '85, 1549.

BAYOU BLACK, LA.—IMPROVEMENT OF.**Appropriations.**

- 1881..... \$10,000, '81, 1289.
 1882..... 10,000, '82, 1380.
 1884..... 5,000, '84, 1277.

Commerce.

Advantages of improvement entirely local, '85, 1402; '86, 1262; '87, 1370.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 195, 197; '82, 191; '83, 209; '84, 213; '85, 219; '86, 217; '87, 183.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1880-'81. Report, '81, 1288.

Maj. A. Stickney, 1881-'84. Reports, '82, 1379; '83, 1120; '84, 1276.

Capt. T. Tuttle, 1884-'85. Report, '85, 215.

Maj. W. H. Heuer, 1885-'—. Reports, '85, 1400; '86, 1261; '87, 1368.

ASSISTANT.

H. S. Douglass. Report, '81, 1289.

Operations. (All operations by hired labor.)

1881-'82. Dredge hull built from joint appropriations of Bayous Black and Terre Bonne, '82, 1380; '83, 209.

1882-'83. 21,000 cubic yards removed by United States dredge, 161 logs and 2 wrecks removed, '83, 1120.

1883-'84. 158,403 cubic yards material, 755 logs, and 3 wrecks removed by United States dredge, '84, 1276.

1884-'85. Dredging by United States dredge, '85, 1401.

1885-'86. Repair of United States dredge, '86, 1263.

1886-'87. No operations, '87, 1370.

Physical Characteristics.

Description of bayou, '85, 1401.

Projects.

By Maj. Howell, 1881, for cleaning the bayou of obstructions and dredging a channel 59 feet wide and 6 feet deep from Bayou Cane to Tigerville, 24 miles, estimated cost, \$47,520, '81, 1288, 1292.

Increased in 1885 to \$31,000, '85, 1402; '87, 1369.

In 1887 Maj. Heuer considered the improvement of the bayou local in its benefits, '87, 1370.

Surveys.

Ordered by act of June 14, 1880, '80, 146. Made under direction of Maj. Howell, 1881, '81, 1288.

BAYOU BOEUF, LA.—IMPROVEMENT OF.**Appropriations.**

1881.....	\$5,000, '81, 1423.
1882.....	5,000, '82, 1560.
1884.....	5,000, '84, 1331.
1886.....	5,000, '86, 1354.

Total..... 20,000

1888..... 6,000, act of August 11, 1888.

Statement of appropriations, '87, 1461.

Commerce.

Justification of improvement, '81, 1427; '85, 1546.

Contracts.

Emmick & Feith, for removal of obstructions, at \$75 per mile, '85, 1503.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213; '82, 209; '83, 218; '84, 222; '85, 235, 244; '86, 231; '87, 196.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaure, 1880-'82. Report, '81, 1423.

Capt. C. A. Miller, 1882-'84. Reports, '82, 1560; '83, 1161; '84, 1331.

Capt. E. Bergland, 1884-'86. Reports, '85, 1502; '86, 1354.

Capt. J. N. Willard, 1886-'— . Report, '87, 1461.

ASSISTANTS.

H. St. Coppée. Report, '81, 1424.

C. Quinn. Report, '85, 1546.

Operations.

1881-'82. By hired labor, 3,264 logs, trees, and stumps removed, and 3 brush heaps destroyed, '82, 1560.

1882-'83. By hired labor, 2,663 logs and trees and 3 brush heaps removed, '83, 1161.

1883-'84. No operations for lack of funds, '84, 1331.

1884-'85. By contract, 1,679 logs, snags, and trees and 35 brush heaps removed, '85, 1503.

1885-'86. No operations for lack of funds, '86, 1354.

1886-'87. No operations, '87, 1462.

Physical Characteristics.

River described, '81, 1425.

Projects.

By Maj. Benyaure, 1880, for improvement from Wallace to the mouth, 280 miles, by removal of obstructions; estimated cost, \$20,020, '81, 1424, 1428.

By Capt. Bergland, 1884, for closing 3 outlets of Boeuf River near Point Jefferson; estimated cost, \$8,500, '85, 235, 1503, 1546.

Surveys.

Ordered by act of June 14, 1880, '80, 158. Made under direction of Maj. Benyaure, 1880, '81, 1423.

Of outlets of Boeuf River, ordered by act of July 5, 1884. Made under direction of Capt. Bergland, 1884, '85, 1545.

BAYOU BUFFALO, TEX. (See BUFFALO BAYOU.)**BAYOU COURTABLEAU, LA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 63.)

Appropriations.

1880.....	\$7,500, '80, 1160.
1881.....	7,500, '81, 1294.
1884.....	4,000, '84, 1279.
1886.....	5,000, '86, 1264.

Total..... 24,000

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '87, 1375.

BAYOU COURTABLEAU, LA.—Continued.**Commerce.**

Statistics, '80, 1176; '84, 1279.

Benefit from work done, '83, 1124.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 145; '81, 195; '82, 191; '83, 210; '84, 213; '85, 220; '86, 218; '87, 184.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Reports, '80, 1160, 1169; '81, 1293.

Maj. A. Stickney, 1881-'84. Reports, '82, 1380; '83, 1121; '84, 1277.

Capt. T. Turtle, 1884-'85. Reports, '85, 1403, 1405.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1403; '86, 1263; '87, 1375.

ASSISTANTS.

H. C. Collins. Reports, '80, 1170; '81, 1294; '83, 1122; '84, 1278; '85, 1404.

Lieut. O. T. Crosby. Report, '87, 1376.

Operations.

1881-'82. Closure of run-out, Bayou Big Fardoche, by brush, timber, and clay dam, built by hired labor; also choking other run-out bayous by felled trees, '82, 1381.

1882-'83. Closure of run-out, Bayou Little Fardoche, with dam, built by hired labor; depth of water on Little Devil Bar increased 3 feet, '83, 210, 1123.

1883-'84. No operations on account of insufficiency of funds, '84, 1277.

1884-'85. Construction of quarter-boat and flat-boat, with pile-driver attached, '85, 1403.

1885-'86. Dams at Little and Big Fardoche rebuilt by hired labor, '86, 1263.

1886-'87. Dams in progress at outlets of Bayou English and repairs made to other dams, '87, 1325.

History of operations, '87, 1375.

Physical Characteristics.

Description of bayous, '80, 1170; '81, 1295.

Projects.

By Maj. C. W. Howell, 1880, to improve low-water navigation between Port Barre and Atchafalaya, by removal of obstructions, closing run-out bayous, and construction of a needle-dam and lock 4 miles above Port Barre; estimated cost, \$40,000, '80, 1160.

In 1883 Maj. Stickney increased the previous estimate by \$38,500, to provide for masonry lock-walls instead of timber construction, previously proposed, '83, 1122, 1124; '85, 1403.

In 1884 Capt. Turtle proposed that all other work be held in abeyance until the bayous on the south side of Bayou Courtableau are closed, at an estimated cost of \$16,000, '85, 1404, 1406; '86, 219.

Surveys.

Examination ordered by act of March 3, 1879, '80, 145, 1169. Made under direction of Maj. Howell, 1880, '80, 1169.

1880. Survey by H. C. Collins, '81, 1293.

BAYOU D'ARBONNE, LA.—IMPROVEMENT OF.**Appropriations.**

1884..... \$5,000, '85, 1506.

1886..... 2,000, '86, 1357.

1888..... 2,000, act of August 11, 1888.

Contracts.

Emmick & Feith, for removing obstructions, at the rate of \$197.50 per mile, '85, 1506.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 227; '85, 236; '86, 232; '87, 195.

ENGINEERS IN CHARGE.

Capt. A. M. Miller, 1884. Report, '84, 1372, 1376.

Capt. E. Bergland, 1884-'86. Reports, '85, 1505; '86, 1356.

Capt. J. H. Willard, 1886-'—. Report, '87, 1458.

ASSISTANTS.

T. M. Farrell. Report, '84, 1372.

F. S. Burrows. Report, '84, 1376.

BAYOU D'ARBONNE, LA.—Continued.**Operations.**

1884-'85. Obstructions removed from 23 miles of channel, '85, 1506.
 1885-'86. No operations for lack of funds, '86, 1356.
 1886-'87. Obstructions removed from 17 miles of channel, '87, 1458.

Physical Characteristics.

Description of bayou, '84, 1372, 1377.

Projects.

By Maj. Miller, 1883, for the removal of logs, snags, and similar obstructions from the bayou between its mouth and Stim's Bluff, a distance of about 42 miles; estimated cost, \$15,000, '84, 1376; '85, 1506.

Surveys.

Ordered by act of August 2, 1882. Made under the direction of Maj. Miller, '84, 1372, 1376, 1380.

BAYOU DE GLAISE, LA.—EXAMINATION OF.**Commerce.**

Benefit of improvement, '80, 1176, 1178.

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 145.

ENGINEER IN CHARGE.

Major Howell. Report, '80, 1176.

ASSISTANT.

H. S. Douglass. Report, '80, 1176.

Physical Characteristics.

Bayou described, '80, 1176.

Plans.

By Maj. Howell, 1879, for improvement of bayou by removal of trees, logs, and brush; estimated cost, \$9,540.

The work not considered susceptible of permanent improvement, '80, 1176, 1178.

Surveys.

Ordered by act of March 3, 1879. Made under direction of Maj. Howell, 1879, '80, 1176.

BAYOU FUSILIER, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '82, 194.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1880-'81. Report, '82, 1333.

Maj. A. Stickney, 1881. Report, '82, 1419.

ASSISTANT.

H. C. Collins. Report, '82, 1419.

Physical Characteristics.

Description of bayou, '82, 1419.

Plans.

Maj. Stickney considered that Bayou Fusilier, except for the improvement of Bayou Teche, is useless to navigation, and hence its channels need no improvement, '82, 1419.

Surveys.

Ordered by act of June 14, 1880, '80, 146. Examination made under direction of Maj. Howell, 1881, '82, 1419.

BAYOU GRAND CAILLOU, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '80, 146; '81, 197; '82, 193.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '82, 1410.

BAYOU GRAND CAILLOU, LA.—Continued.**Engineers—Continued.****ASSISTANT.**

H. S. Douglass. Report, '82, 1411.

Physical Characteristics.

Description of bayou, '82, 1411.

Plans.

By Maj. Stickney, 1882, for dredging a channel 30 feet wide and 4 feet deep from junction of Bayou Pelton to Woodlawn plantation, a distance of 5 miles, and removing trees and other obstructions to junction of Bayou du Lac; estimated cost \$10,208, '82, 1412.

Surveys.

Ordered by act of June 14, 1890, '80, 146. Made under direction of Maj. Stickney, 1882, '82, 1410.

BAYOU LA FOURCHE, LA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 63.)

Appropriations.

1880.....\$5,000, '80, 1162.
1884.....5,000, '84, 1281.
1888.....50,000, act of August 11, 1888.

Commerce.

Importance of improvement, '80, 1161; '84, 1281.

Interests affected, '86, 1269, 1274; '87, 1366.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 196; '82, 192; '83, 211; '84, 214, 216; '85, 221; '86, 219; '87, 182, 184.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1873-'81. Reports, '80, 1161; '81, 1299.

Maj. A. Stickney, 1881-'84. Reports, '82, 1384; '83, 1126; '84, 1280, 1291.

Capt. T. Turtle, 1884-'85, '85, 1408.

Maj. W. H. Heuer, 1885-'—. Reports, '85, 1408; '86, 1266; '87, 1365.

ASSISTANTS.

H. Stewart. Report, '84, 1292.

Lieut. O. T. Crosby, '85, 1408. Report, '86, 1267.

Operations.

1879-'80. 827 snags, stumps, and logs, and 10 wrecks removed by hired labor, '80, 1161.

1880-'81. 771 snags, stumps, and logs removed by hired labor, '81, 1299.

1881-'82. 1,283 obstructions removed by hired labor, '82, 1384.

1882-'83. 487 obstructions removed by hired labor, '83, 1126.

1883-'84. No operations for lack of funds, '84, 1280.

1884-'85. Removal of obstructions by hired labor, '85, 1408.

1885-'86. Completion of survey ordered in 1882, '86, 1266.

1886-'87. No operations, '87, 1366.

Physical Characteristics.

Action of floods in bayous, '86, 1271.

High-water slopes, '86, 1272.

Sediment, '86, 1273.

Plans.

Lieut. Crosby, 1886, for the improvement of Bayou La Fourche by the construction of a lock at Donaldsonville to connect with the Mississippi River, converting the bayou into a salt-water canal, with dredging in the bayou so as to form a channel 5 feet deep and 75 feet wide; estimated cost, \$450,000, with annual cost of maintenance of \$8,000, '86, 1267, 1274, 1275; '87, 1366.

Projects.

By Maj. Howell, in 1879, to afford low-water navigation in the bayou below Donaldsonville by the removal of snags, wrecks, and rafts, '79, 901; '81, 196.

Surveys.

Ordered by act of August 2, 1882, '84, 216. Made under direction of Capt. Stickney, 1883, '84, 1291. Line of levels incomplete, '84, 1292; completed, '86, 1266, 1268.

MAPS.

'86, 1268.

BAYOU LITTLE CAILLOU, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '82, 193.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '82, 1412.

ASSISTANT.

H. S. Douglass. Report, '82, 1413.

Physical Characteristics.

Description of bayou, '82, 1413.

Plans.

By Maj. Stickney, 1882, for widening, by dredging, the existing channel from Boudro's Canal to 24 miles above that point for a distance of 4 miles, a channel 4 feet deep and 30 feet wide, together with the removal of obstructions; estimated cost, \$7,392, '82, 1414.

Surveys.

Ordered by act of June 14, 1880, '80, 146. Made under direction of Maj. Stickney, 1882, '82, 1412.

BAYOU LOGGY, LAKE BISTENAU, AND THE DORCHEAT, LA.—IMPROVEMENT OF.**Appropriations.**

1884..... \$5,000, '85, 1497.

1888..... 5,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 227; '85, 233; '86, 230; '87, 195.

ENGINEERS IN CHARGE.

Capt. A. M. Miller. Report, '84, 1363.

Capt. E. Bergland, 1884-'86. Reports, '85, 1496; '86, 1350.

Capt. J. H. Willard, 1886-'— . Report, '87, 1454.

ASSISTANT.

P. C. Montgomery. Report, '84, 1363.

Operations.

1884-'85. Removal of obstructions from Murrell's Point, on the Dorcheat, to the mouth of Loggy Bayou, '85, 1496.

1885-'87. No operations for lack of funds, '86, 1350; '87, 1455.

Plans.

Capt. Miller considered, in 1883, that the improvement would involve an expense not justified by the amount of commerce to be benefited, '84, 1363.

Projects.

From the examination made in 1882 it was estimated that the cost of removing obstructions, so as to increase the season of navigation two months would cost \$19,338, '84, 1366; '85, 1476.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Miller, '84, 1363.

BAYOU MACON, LA.—IMPROVEMENT OF.

(See also TENSAS RIVER, LA.)

Appropriations.

The river and harbor act of July 5, 1884, united this improvement with that of Tensas River, La., '84, 400; '85, 1504.

Commerce.

Justification of the improvement, '81, 1463.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 213; '85, 236; '86, 232; '87, 197.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard. Report, '81, 1462.

Maj. A. M. Miller, 1885. Report, '85, 1504.

Capt. E. Bergland, 1886. Report, '86, 1355.

Capt. J. H. Willard, 1887-'—. Report, '87, 1463.

BAYOU MACON, LA.—Continued.**Engineers.—Continued.****ASSISTANT.**

F. S. Burrows. Report, '81, 1463.

Physical Characteristics.

Described, '81, 1463.

Operations.

1884-'86. No operations, from insufficient funds, '85, 1504; '86, 1355.

1886-'87. Obstructions removed from Floyd's to junction of bayou with Tensas River, '87, 1464.

Plans.

By Maj. Benyaure, 1880, for clearing the bayou of logs, snags, and similar obstructions from its head to junction with Tensas River; estimated cost, \$17,000, '81, 1463.

Projects.

By the act of July 5, 1884, the improvement of Bayou Macon was united with that of Tensas River, La., by the adoption of Maj. Benyaure's plan of 1880 for the removal of logs, trees, and similar obstructions from Bayou Macon from Floyd's to its junction with Tensas River, a distance of 130 miles; estimated cost, \$17,000, '81, 1463; '84, 400; '85, 1504.

Surveys.

Examination ordered by act of June 14, 1880. Made under the direction of Maj. Benyaure, 1880, '81, 1462.

BAYOU METRE (Meto). ARK.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 232.

ENGINEER IN CHARGE.

Capt. T. H. Handbury. Report, '84, 1408.

Plans.

Capt. Handbury considered, in 1882, that any expenditure of public funds would be purely for the benefit of local interests and that it was not worthy of improvement, '84, 1408.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Handbury, '84, 1408.

BAYOU AND PASS MANCHAC, LA.—EXAMINATION OF.

(Continued from Vol. I, p. 64.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '82, 194.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '82, 1414.

ASSISTANT.

J. C. Buchanan. Report, '82, 1415.

Plan.

By Maj. Stickney, 1882, for an improvement by removal of obstructions from lower part of Bayou Manchac, from its junction with the Amite River to Lake Maurepas and thence to Bobbins; estimated cost, \$3,450, '82, 1415.

Survey.

Ordered by act of June 14, 1880, '80, 146. Made under direction of Maj. Howell, 1881, '82, 1415.

BAYOU PETIT ANSE, LA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 227.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1369.

ASSISTANT.

P. C. Montgomery. Report, '84, 1369.

Plans.

Capt. Miller considered, in 1883, that since the navigation could only be improved by dredging, and the only interest to be benefited was a salt company, the work was not worthy of improvement or a public necessity, '84, 1369.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Miller, 1882, '84, 1369.

BAYOU PIERRE, LA.—SURVEY OF.

(See also RED RIVER, LA.)

(Continued from Vol. I, p. 64.)

Appropriations.

1884 (survey)..... \$3,600, '85, 232.

The act of July 5, 1886, provides for the completion of the survey, '86, 229, 459.

Engineers.

CHIEF OF ENGINEERS.

Reports, '83, 213; '84, 221, 227; '85, 232; '86, 229; '87, 194.

ENGINEERS IN CHARGE.

Capt. A. M. Miller. Report, '83, 1139.

Capt. E. Bergland, 1885-'86. Reports, '85, 1487; '86, 1343.

Capt. J. H. Willard, 1886-'— . Report, '87, 1453.

ASSISTANTS.

J. Birney. Report, '83, 1139.

H. Vance. Report, '85, 1491.

Operations.

1884-'87. Survey in progress, '85, 1487; '86, 1343; '87, 1453.

Physical Characteristics.

Description of bayou, '85, 1487, 1491; '86, 1343.

Description of raft, '85, 1488.

Plans.

History of previous plans, '85, 1489.

By Capt. Miller, 1883, for removal of raft from Bayou Pierre, at an estimated cost of \$100,000, '83, 1139.

Surveys.

Examination made under the direction of Capt. Miller, 1883, '83, 1139.

Survey ordered by act of July 5, 1884. Made under direction of Capt. Bergland, '85, 1487.

MAPS.

Red River in vicinity of Bayou Pierre, '85, 1490.

BAYOU PIERRE, MISS.—EXAMINATION AND IMPROVEMENT OF.**Appropriations.**

1886..... \$5,000, '87, 1383.

Commerce.

Statistics, '85, 1441, 1444.

No commerce to be benefited, '87, 1383.

Engineers.

CHIEF OF ENGINEERS.

Reports, '85, 226; '87, 185.

ENGINEERS IN CHARGE.

Capt. T. Turtle, 1885. Report, '85, 1439.

Maj. W. H. Heuer, 1885-'—. Reports, '85, 1440; '87, 1382.

BAYOU PIERRE, MISS.—Continued.**Operations.**

1886-'87. Obstructions from mouth to a point 16 miles above removed, thereby completing project, '87, 1382.

Physical Characteristics.

Bayou described, '85, 1441; '87, 1382.

Projects.

By Maj. Heuer, for the improvement of bayou to a point 16 miles above its mouth by the removal of logs, snags, and trees; estimated cost, \$20,000, '85, 1444. Project completed in 1886, '87, 1382.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Heuer, '85, 1440.

BAYOU PLAQUEMINE, LA.—EXAMINATION AND SURVEY OF.

[\$100,000 appropriated by act of August 11, 1888.]

Commerce.

Commercial statistics, '87, 1406.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '82, 194; '87, 188, 1406.

ENGINEERS IN CHARGE.

Maj. A. Stickney. Reports, '82, 1416; '85, 2973.

Capt. T. Turtle. Report, '85, 1431.

Maj. W. H. Heuer. Report, '87, 1406, 1407.

ASSISTANTS.

A. O. Wilson. Report, '85, 2984.

Lieut. O. T. Crosby. Report, '87, 1407.

Physical Characteristics.

Description of bayou, '82, 1417.

Character of bed of bayou, '87, 1411.

Plans.

In 1884 Capt. Turtle did not consider Bayou Plaquemine worthy of improvement, '85, 1431.

In 1885 Maj. Stickney considered the improvement of the Plaquemine route via Atchafalaya and Red Rivers feasible, at an estimated cost of \$1,708,250, '85, 2973, 2984; '87, 1406, 1412.

In 1887 Lieut. Crosby estimated the cost of a lock to connect Bayou Plaquemine with the Mississippi River at \$250,000, '87, 1407, 1412.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Stickney, '82, 1416.

Of mouth of bayou, with a view to connecting with the Mississippi River by locks. Also of the bayou and other connecting streams to form the best route to Grand Lake. Ordered by act of August 5, 1886. Made under direction of Maj. Heuer, '87, 1406.

BAYOU ROUGE, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 188.

ENGINEERS IN CHARGE.

Maj. W. H. Heuer, 1887. Report, '87, 1393.

Lieut. O. T. Crosby, 1887. Report, '87, 1393.

Physical Characteristics.

Description of the bayou, '87, 1393.

Plans.

Lieut. O. T. Crosby, 1887, reports the bayou as unworthy of improvement, '87, 1396.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Heuer, '87, 1393.

BAYOUS ROUNDAWAY AND VIDAL, LA.—EXAMINATIONS OF.

[§1,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 227; '87, 203.

ENGINEERS IN CHARGE.

Capt. A. M. Miller. Report, '84, 1347.

Capt. J. H. Willard. Report, '87, 1497.

ASSISTANT.

T. M. Farrell. Report, '84, 1348.

Plans.

Capt. Miller, considered in 1882, in view of the estimated cost of the improvement, \$16,000, and the small amount of commerce to be benefited, that the work was not worthy of improvement, and also not a public necessity, '84, 1348.

Capt. Willard, 1887, reports adversely to improvement, in view of great cost and small amount of commerce to be benefited, '87, 1498.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Miller, '84, 1347.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Willard, '87, 1497.

BAYOU TECHE—CANAL CONNECTING WITH GRAND LAKE AT CHARENTON, LA.**Appropriations.**

1881..... \$25,000, '81, 1288.

Commerce.

Amount to be benefited by the improvement, '80, 1189.

Plantations on bayou not directly benefited, '85, 1400; '86, 1260.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 145; '81, 194; '82, 190; '83, 209; '84, 212; '85, 218; '86, 216; '87, 184.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Reports, '80, 1187; '81, 1287.

Maj. A. Stickney, 1881-'84. Reports, '82, 1378; '83, 1116; '84, 1275.

Capt. T. Turtle, 1884-'85. Report, '85, 215.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1399; '86, 1259; '87, 1374.

ASSISTANT.

H. C. Collins. Reports, '80, 1188; '83, 1118; '84, 1275.

Legislation.

State legislation ceding jurisdiction of land to United States, '82, 1379.

Operations.

None beyond surveys and studies, '86, 1260; '87, 1374.

Plans.

By Maj. Stickney, 1882, for an open canal 100 feet wide at bottom and without lock. Estimated cost, by contract, \$130,350; by hired labor, \$85,000.

For canal 50 feet wide at bottom, with lock. Estimated cost, by contract, \$138,600; by hired labor, \$123,125, '83, 1117, 19; '84, 1275. Not deemed advisable by the Chief of Engineers to expend available funds for construction of the plant required to perform the work by hired labor, '84, 1275.

Private and Corporate Work.

Right of way given by the Charenton Canal Company, '82, 1379; '83, 1116.

Projects.

By Maj. Howell, 1880, for the construction of a canal connecting Bayou Teche at Charenton with Grand Lake. Canal 6,594 feet long, 50 feet wide at bottom, and from 5 to 6 feet deep at ordinary low water, provided with a lock with double gates. Estimated cost, \$75,000, '80, 1189; '86, 1260. Modified in 1885 by a canal 100 feet wide at bottom and without locks, '84, 1275; '85, 1399.

Recommended by Maj. Heuer that no work be done until \$75,000 has been appropriated, '86, 1260; '87, 1374.

Surveys.

Ordered by act of June 28, 1879, '80, 145. Made under direction of Maj. Howell, '80, 1187.

1882. Survey for location of canal, '83, 209.

BAYOU TECHE, LA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 64.)

Appropriations.

1870.....	\$18,000
1880.....	6,000, '80, 1159.
1881.....	20,000, '81, 1286.
1884.....	6,500, '84, 1273.

Total 50,500

Commerce.

Large amount of commerce to be benefited, '80, 1163; '84, 1273; '86, 1249; '87, 1373.

Small commercial requirement of the bayou above Saint Martinsville, '86, 1250.

Contracts.

1881. G. A. Meyer, for removal of obstructions, '81, 1285. Unsatisfactory character of work done, '85, 1397.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 144, 145; '81, 194; '82, 190; '83, 209; '84, 213; '85, 217; '86, 215; '87, 183.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Reports, '80, 1159, 1166; '81, 1285.

Maj. A. Stickney, 1881-'84. Reports, '82, 1378; '83, 1111; '84, 1272.

Capt. T. Turtle, 1884-'85. '85, 1397.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1397; '86, 1245, 1248; '87, 1370.

ASSISTANTS.

II. C. Collins. Reports, '80, 1166; '83, 1113; '84, 1274.

Lieut. O. T. Crosby. Reports, '86, 1251; '87, 1371.

Operations.

1880-'81. Obstructions removed by contract between Saint Martinsville and Leon's Bridge, '81, 1286.

1881-'82. No operations, '82, 1378.

1882-'83. Survey of bayou from Charenton Canal to Port Barre, '83, 209.

1883-'84. Completion of maps and preparation of plans for improvement, '84, 1272.

1884-'85. The wreck of a steamer and 435 snags and logs removed by hired labor from bayou between New Iberia and Saint Martinsville, '85, 1398.

1885-'86. Removal of obstructions, by hired labor, to a point about 19 miles below head of bayou, '86, 1247.

1886-'87. Removal of obstructions to headwaters of the bayou, '87, 1370.

Physical Characteristics.

Description of bayou, '80, 1167; '83, 1114; '86, 1249.

Current observations and discharge, '86, 1251, 1254.

Plans.

By Maj. Stickney, 1883, for carrying a low-water depth of 5 feet to within 4 miles of Port Barre, by clearing the bayou of obstructions and by dredging, and the construction of two locks and dams. Estimated cost, \$135,625, '83, 1112, 1116; '86, 1246.

Locks to be 300 feet long, 50 feet wide, and 8 feet lift; the lower lock to be placed about 5 miles below Saint Martinsville; the upper lock 2 miles below Breauux Bridge, '84, 1274; '85, 1398.

In 1886 Lieut. Crosby estimated the cost of a single movable dam, with lock, 14 miles below Saint Martinsville, at about \$175,000, '86, 1250, 1257; '87, 1370.

Maj. Heuer recommends that no appropriation be made for the construction of lock and dam until the capacity of present improvement has been tested, '85, 1399; '86, 125; '87, 1371.

Projects.

By Maj. Howell, 1880 for improvement of Bayou Teche, from New Iberia to Leonville, by the removal of obstructions and the construction of three movable dams. Estimated cost, \$56,690, '80, 1159, 1166, 1169; '82, 1378.

Maj. Heuer recommends that no appropriation for lock and dam be made until the capacity of the present improvement has been tested, '85, 1399; '86, 125; '87, 1371.

(See PLANS.)

Surveys.

Ordered by act of March 3, 1879, '80, 145. Made under direction of Maj. Howell, 1879, '80, 1166.

1882. From Charenton Canal to Port Barre, under direction of Maj. Stickney, '83, 1113; '85, 1397.

1885. From Charenton Canal to mouth, under direction of Lieut. Crosby, '85, 1398.

BAYOU TERREBONNE, LA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 65.)

Appropriations.

1880.....	\$10,000, '80, 1158.
1881.....	8,800, '81, 1299.
1882.....	7,000, '82, 1384.
1886.....	10,000, '86, 1265.

Total 35,800

1888..... 3,000, act of August 11, 1888.

Dredge-hull built in 1881 from joint appropriations of Bayous Terrebonne and Black, '82, 1382.

Statement of appropriations, '87, 1367.

Commerce.

Advantages to commerce from improvement, '84, 1280; '85, 1408.

Amount of commerce benefited, '85, 1407.

Contracts.

H. A. Peeler, for construction of dredge-hull for \$5,649, '82, 1383.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 143, 145; '81, 195; '82, 192; '83, 210; '84, 214; '85, 221; '86, 219; '87, 182.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Reports, '80, 1158, 1179; '81, 1297.

Maj. A. Stickney, 1881-'84. Reports, '82, 1382; '83, 1125; '84, 1279.

Capt. T. Turtle, 1884-'85. '85, 1407.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1407; '86, 1264; '87, 1367, 1396.

ASSISTANTS.

W. H. Hoffman. Report, '80, 1179.

Lieut. O. T. Crosby. Report, '87, 1396.

Operations.

1880-'81. 7½ miles of channel below Houma deepened by hired labor and use of hired dredge, '81, 1298.

1881-'82. 8½ miles of channel 38 to 40 feet wide and 4 feet deep obtained by hired labor and use of hired dredge. Construction of dredge-hull by contract, '82, 1382.

1882-'83. 4 miles of channel 40 feet wide and 6 feet deep obtained by hired labor and use of United States dredge, '83, 1125.

1883-'86. No operations for lack of funds, '84, 1279; '85, 1407; '86, 1264.

1886-'87. 164,165 cubic yards dredged by United States dredge. History of operations, '87, 1367.

Physical Characteristics.

Bayou 11 feet wide at upper end of improvement, '81, 1298.

Plans.

In 1886 Maj. Heuer did not consider the bayou between Houma and Thibodeaux worthy of improvement, '87, 1396.

Projects.

By Maj. Howell, 1879, for the formation of a low-water channel 4 feet deep, from Houma to a point about 20 miles below, by the removal of overhanging trees from the right bank and the dredging of shoal areas. Estimated cost, \$18,800, '80, 1158, 1179, 1180. Increased for dredging, \$15,000, '81, 1298. Increased for dredging, \$5,000, '82, 1383; '87, 1367. Work not considered permanent, '80, 1158; '82, 1383; '87, 1368.

Surveys.

Ordered by act of March 3, 1879, '80, 145. Examination made under direction of Maj. Howell, 1879, '80, 1179. From Houma to Thibodeaux, ordered by act of August 5, 1886. Made under direction of Maj. Heuer, '87, 1396.

BAYOU VERMILLION, LA. (See VERMILLION RIVER, LA.)**BAYOU VIDAL, LA.** (See BAYOUS ROUNDWAY AND VIDAL, LA.)

BAY RIVER, ARK.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard. Report, '81, 1497.

ASSISTANT.

J. B. Rohrer. Report, '81, 1497.

Plans.

Maj. Benyaard considers that commercially the stream is of no importance, and no improvement is recommended, '81, 1498.

Surveys.

Ordered by act of June 18, 1878, '80, 158. Made under direction of Maj. Benyaard, 1880, '81, 1497.

BAY RIVER, N. C.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 177.

ENGINEER IN CHARGE.

Capt. J. Mercur. Report, '84, 1064.

Plans.

Capt. Mercur considered in 1883 that, since the river affords in its present condition easy navigation to all existing commerce, it is not worthy of improvement and the work not a public necessity, '84, 1064.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Mercur, '84, 1064.

BEAR CREEK, MISS.—Examination ordered by act of August 5, 1886, '87, 236.**BEAR CREEK (branch of the Tennessee River), MISS.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '81, 258.

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '82, 1869.

ASSISTANT.

J. H. Mayhew. Report, '82, 1870.

Physical Characteristics.

Description of, '82, 1870.

Plans.

By Maj. King, 1881, for the improvement of 12 miles of the creek by the removal of snags and fish-traps. Estimated cost, \$5,900, '82, 1869, 1871.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1881, under the direction of Maj. King, '82, 1869.

BEAR CREEK (branch of the Yazoo River), MISS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 213; '82, 210.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard. Report, '82, 1563.

ASSISTANT.

W. S. Davis. Report, '82, 1563.

BEAR CREEK (branch of the Yazoo River), MISS.—Cont'd.**Physical Characteristics.**

Description of, '82, 1563.

Plans.

By Maj. Benyaure, 1881, for clearing out obstructions from about 44 miles of the creek and connecting lakes at an estimated cost of \$6,000, '82, 1563, 1565.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1881, under the direction of Maj. Benyaure, '82, 1563.

BEATTYVILLE, KY.—LOCK AND DAM AT.

(See KENTUCKY RIVER.)

BEAUFORT HARBOR, N. C.—IMPROVEMENT OF.**Appropriations.**

1836.....	\$5,000
1881.....	30,000, '81, 1013.
1882.....	*30,000, '82, 1093.
1884.....	20,000, '84, 1039.
1886.....	15,000, '86, 989.

Total 100,000.

1888..... 35,000, act of August 11, 1888.

Commerce.

Draught of vessels seeking entrance, '81, 1015.

Importance of the harbor, '81, 1014; '82, 1096; '85, 1079; '87, 1036.

Contracts.

1888. F. Linehan & Co., for stone, at \$2.95 per ton, '87, 1034.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 164; '82, 159, 1095; '83, 166; '84, 169; '85, 168, 1082; '86, 164; '87, 128.

BOARD OF ENGINEERS.For river and harbor improvements. Report, '82, 1096. (See PROJECTS.)
(Cols. Tower, Newton, and Lieut. Col. Abbot.)**ENGINEERS IN CHARGE.**

Capt. C. B. Phillips, 1880-'81. Report, '81, 1013.

Capt. J. Mercur, 1881-'84. Reports, '82, 1093, 1094; '83, 885.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1039.

Capt. W. H. Bixby, 1885-'—. Reports, '85, 1076, 1080; '86, 986; '87, 1030.

ASSISTANTS.

C. M. Yeates. Report, '81, 1014.

R. Ransom. Reports, '82, 1094; '83, 856; '84, 1040; '85, 1077; '86, 985; '87, 1034.

H. F. Price. Report, '85, 1078.

E. D. Thompson. Report, '87, 1035.

Operations.

1881-'82. Two scows built by hired labor; 30 linear feet of jetty built, '82, 1093, 1094; '86, 989.

1882-'83. Jetty at Shackleford Point extended to length of 535 feet. Two scows and temporary wharf and tram-way built. Work done by hired labor, '83, 855, 856. Cost of jetty, and satisfactory action of, '83, 857; '86, 989.

1883-'84. Repairs by hired labor to jetty, sand fences, and wharf, '84, 1039.

1884-'85. Jetty 400 feet long, built on north side of Shackleford Point, 2,300 feet east of main jetty. Main jetty covered with concrete; superstructure 6 feet wide, 3 feet high for a distance of 444 feet. Repairs to sea end of main jetty; 721 linear yards of shore revetment laid between main and east jetty. At Macon Point a breach was closed by 420 linear feet of crib-work, a small receiving wharf was constructed, and a jetty started northeast of the fort. Work done by hired labor and purchase in open market, '85, 1076, 1077; '86, 990.

* \$5,000 to be applied to the inland navigation from Beaufort Harbor to New Berne, '83, 106, 885.

BEAUFORT HARBOR, N. C.—Continued.**Operations.**—Continued.

1885-'86. Strengthening jetties at Shackleford Point and placing 100 linear feet of shore protection between the jetties. Extension of Jetty No. 1 at Fort Macon Point 120 feet; commencement of Jetty No. 2, and rebuilding landing wharf, '86, 165, 987, 990.

1886-'87. 1,119 tons of stone placed in works at Fort Macon Point, Cove Sound, and Shackleford Point, '87, 1032, 1034.

Physical Characteristics.

Recession of Shackleford Point, '81, 1016; '82, 1094, 1097; '84, 170; '85, 168; '86, 987.

Direction of tidal currents, '82, 1077.

Change effected by jetty built in 1883, '83, 1095.

Projects.

By Capt. Phillips, 1880, for the construction of three jetties of random stone, to prevent further abrasion of Shackleford Point, and the dredging of two channels, and a turning basin near Beaufort; estimated cost, \$82,103.38, '81, 1013, 1017.

In 1881 Capt. Mercur recommended a system of jetties for projection of Shackleford Point of random stone, about 300 feet long and spaced about 300 feet apart, '82, 1095. Plan approved by Board of Engineers, with recommendation that the jetties should be founded upon mattresses, '82, 1098. Concurred in by Chief of Engineers and approved by Secretary of War, '82, 1096.

In 1884 Capt. Bixby recommended the expansion of the project to cover the protection of Fort Macon Point from erosion by shore protection and jetties, '85, 168, 1081. After an expenditure of \$75,000 on previous project, it was estimated in 1886 that \$84,000 would be required for the complete protection of Shackleford and Fort Macon Points, and the formation of a dredged channel 100 feet wide and 5 feet deep at mean low water, from Bulkhead Channel to Beaufort, '86, 989; '87, 1030.

Surveys.

Ordered by act of June 14, 1880, '80, 125. Made under direction of Capt. Phillips, 1880, '81, 1013.

1881. Survey of Shackleford Banks, '82, 1094.

List of surveys, '81, 1015; '82, 1096; '86, 989.

MAPS.

1876, '85, 1076; 1884, '83, 856; 1885, '85, 1076.

BEAUFORT HARBOR AND NEW RIVER, N. C.—WATERWAY BETWEEN.

(See also NEW RIVER, N. C.)

Appropriations.

1886..... \$10,000, '87, 1038.

1888..... 5,000, act of August 11, 1888.

Commerce.

Justification of the improvement, '85, 1134, 1135; '87, 1037.

Contracts.

1886. R. Moore, dredging, at 32½ cents per cubic yard, '87, 1038.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 177; '85, 177; '87, 129.

ENGINEERS IN CHARGE.

Capt. J. Mercur. Report, '84, 1055.

Capt. W. H. Bixby, 1885— Reports, '85, 1133, 1135; '87, 1037.

ASSISTANTS.

J. P. Darling. Reports, '84, 1055; '85, 1138.

R. Ransom. Report, '85, 1134.

E. D. Thompson. Report, '87, 1038.

Physical Characteristics.

Description of route, '84, 1055; '85, 1133, 1136.

Plans.

By Capt. Bixby, 1885, for the formation of dredged channels from 3 to 9 feet deep from White to New Rivers. Estimated cost from \$78,000 to \$540,000. This cost was considered as incommensurate with the benefit to be derived, '85, 1137.

BEAUFORT HARBOR AND NEW RIVER, N. C.—Continued.**Projects.**

By Capt. Bixby, 1885, for the formation of an improved channel by dredging 3 feet deep at low water, and extending from Beaufort to Swansborough on the White Oak River; estimated cost, \$50,000, '85, 1138; '87, 1037.

Surveys.

Ordered by act of August 2, 1882. Made under the direction of Capt. Mercier, 1882, '84, 1055.

Also by act of July 5, 1884. Made under direction of Capt. Bixby, '85, 1133, 1135.

MAPS.

Bogue Sound and vicinity, '80, 896.

BEAUFORT TO NEW BERNE, N. C.—INLAND LINE OF NAVIGATION BETWEEN.

(See NEW BERNE TO BEAUFORT, N. C.—INLAND LINE OF NAVIGATION BETWEEN.)

BEAVER BAY, MINN.—SURVEY FOR HARBOR OF REFUGE AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 247; '82, 266.

ENGINEER IN CHARGE.

Capt. C. J. Allen. Report, '82, 2108.

ASSISTANT.

S. L. Bayless, '82, 2109.

Plans.

For the construction of two crib breakwaters aggregating 1,450 linear feet in length, at an estimated cost of \$150,000, '82, 2109.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under the direction of Capt. Allen, '82, 2108.

BELAMY RIVER, N. H.—SURVEY OF.

[\$10,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 22.

ENGINEER IN CHARGE.

Maj. J. A. Smith. Report, '87, 484, 485.

ASSISTANT.

F. S. Burrows. Report, '87, 486.

Plans.

By Maj. Smith, 1887, for excavation of a channel 50 feet wide and 5 feet deep at mean low water from mouth to head of navigation; estimated cost, \$28,000, '87, 486.

Surveys.

Examination and survey ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Smith, '87, 484, 485.

BELFAST HARBOR, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 65.)

Appropriations.

1826-79 \$27,800.
 1880 3,000, '80, 330.
 Statement of appropriations, '87, 445.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 64; '81, 65; '82, 65; '83, 60; '84, 69; '85, 57; '86, 56; '87, 16.

ENGINEERS IN CHARGE.

Col. G. Thom, 1875-'85. Reports, '80, 330; '81, 463; '82, 491; '83, 412; '84, 463.

Col. C. E. Blunt, 1885-'86. Report, '85, 467.

Maj. J. A. Smith, 1886-'— Reports, '86, 535; '87, 445.

Operations.

1879-'80. Removal of shoal in front of wharves by use of hired dredge and plant, '80, 330. Completion of project of 1877, at a cost of \$22,000, '80, 65, 331.

In 1883 an examination showed that no refilling had occurred over dredged areas, '84, 463.

1885-'86. Wreck of schooner Waldemar removed, '86, 536.

1886-'87. No operations, '87, 445.

Plans.

By Col. Thom, 1880, for the construction of a jetty from north shore of harbor to direct tidal currents; estimated cost, \$18,000, '80, 331.

Projects.

By Col. Thom, 1877, for deepening, by dredging, to depth of 10 and 12 feet, the area between the wharves and deep water in the river, '76, i, 190. Completed in 1880 at a cost of \$22,000, '80, 65, 331.

Surveys.**MAPS.**

'80, 330.

BELLAIRE, OHIO—EXAMINATION FOR ICE HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 195; '81, 263.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '81, 1951.

ASSISTANT.

J. H. Harlow. Report, '81, 1952.

Plans.

By Maj. Merrill, 1881, for the protection of the landing against ice, by the construction of two crib-piers, intermediate between the present piers in the railroad bridge; estimated cost, \$7,500, '81, 1951, 1953.

Surveys.

Ordered by act of March 3, 1879, '80, 195. Made under direction of Maj. Merrill, 1881, '81, 1951.

BELLE PLAINE, MINN. (See MINNESOTA RIVER, MINN.)**BELLE RIVER, MICH. ICE HARBOR OF REFUGE AT.**

(Continued from Vol. I, p. 66.)

Appropriations.

1881 \$7,000, '81, 2253.
 1882 5,000, '83, 1875.
 1884 2,000, '85, 2159.

Commerce.

Danger to shipping from movement of ice in river, '80, 2060.

Necessity for protection against ice, '80, 2060, 2062.

BELLE RIVER, MICH.—Continued.**Contracts.**

1881. Carlin, Stickney & Cram, for dredging, at 13 cents per cubic yard, '81, 2253.
 1882. T. M. Hubbell, for dredging, at 16 cents per cubic yard, '83, 1876.
 1885. T. M. Hubbell, for dredging, at 20 cents per cubic yard, '85, 2159.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 221; '81, 299; '82, 294; '83, 303; '84, 306; '85, 329; '86, 324; '87, 291.

ENGINEERS IN CHARGE.

- Maj. F. Harwood, 1879-'82. Reports, '80, 2059; '81, 2252; '82, 2335.
 Maj. F. N. Farquhar, 1882-'83. Report, '83, 299.
 Lieut. Col. O. M. Poe, 1883—'. Reports, '83, 1875; '84, 2070; '85, 2157; '86, 1837; '87, 2262.

Operations.

- 1881-'82. 40,873 cubic yards dredged between mouth of river and first bridge, '82, 2335.
 1882-'83. 28,235 cubic yards dredged between first and second bridges, '83, 1875.
 1883-'84. No operations for lack of funds, '84, 2070.
 1884-'85. 8,100 cubic yards dredged, completing project, '85, 2158; '87, 2262.

Projects.

- By Maj. F. Harwood, 1880, for the formation of a channel 50 feet wide and 13 feet deep, from mouth of river to Marine City draw-bridge, and from there to second bridge 12 feet deep; estimated cost, \$14,465, '80, 2060; '83, 1875. Project completed in 1885, at a cost of \$14,000, '85, 2158; '87, 2262.

Surveys.

- Ordered by act of March 3, 1879, '80, 221.
 Made under direction of Maj. Harwood, 1880, '80, 2059.
 MAP.
 1882, '82, 2336.

BENTON HARBOR, MICH. (See SAINT JOSEPH'S RIVER, MICH.)**BERGEN NECK, N. J., SHIP-CANAL ACROSS—SURVEY FOR.****Commerce.**

- Justification of improvement, '80, 533.

Engineers.**CHIEF OF ENGINEERS.**

- Report, '80, 85.

ENGINEER IN CHARGE.

- Lieut. Col. J. Newton. Report, '80, 529.

ASSISTANT.

- R. H. Talcott. Report, '80, 530.

Physical Characteristics.

- Described, '80, 531. Tidal obstructions, '80, 531.

Plans.

- By Lieut. Col. Newton, 1880, for connecting Newark Bay with upper New York Bay by a canal 4,500 feet long, 12 feet deep at mean low water, and 200 feet wide at bottom; estimated cost, exclusive of land damages, \$3,332,426.88, '80, 530, 532.

Private, State, and Corporate Work.

- Morris Canal crosses Bergen Neck at site proposed for ship-canal, '80, 531.

Surveys.

- Ordered by act of March 3, 1879, '79, 66, 1879.
 Made under direction of Col. Newton, 1880, '80, 530.
 MAPS.
 '80, 530.

BIDDLE'S POINT, at Mackinac Harbor, MICH.—WITH VIEW TO CONSTRUCTION OF BREAKWATER.

(See MACKINAC CITY, MICH., SURVEY FOR BREAKWATER AT.)

BIG BAYOU METRE (Meto), ARK. (See BAYOU METRE (METO), ARK.)**BIG BLACK RIVER, MISS.—IMPROVEMENT OF.****Appropriations.**

1884 \$5,000, '85, 1525.
 1886 5,000, '86, 1365.

Commerce.

Bridges without draws obstructing navigation, '82, 1566; '85, 241, 1524; '86, 236.
 Action of State legislature required before further expenditures will be made, '87, 1466.

Encroachments.

Bridges without draws obstructing navigation, '82, 1566; '85, 241, 1524.
 No further expenditures to be made until action of State removes obstructing bridges, '87, 1466.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 213; '82, 210; '85, 241; '86, 236; '87, 198.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1881. Report, '82, 1565.

Capt. E. Bergland, 1884-'86. Reports, '85, 1524; '86, 1365.

Capt. J. H. Willard, 1886-'—. Report, '87, 1465.

ASSISTANTS.

W. S. Davis. Report, '82, 1566.

W. Porterfield. Report, '85, 1525.

Operations.

1884-'85. Obstructions removed from mouth to 75 miles above, '85, 1524, 1527.

1885-'86. No operations for lack of funds, '86, 1365; '87, 1466.

No further work proposed until legislative action is obtained to remove obstructions of existing bridges, '87, 1466.

Physical Characteristics.

Description of river, '82, 1567.

Projects.

By Maj. Benyaard, 1881, for the removal of logs, snags, and similar obstructions from the river, between the mouth and Cox's Ferry, a distance of 130 miles; estimated cost, \$32,000, '82, 1566, 1570; '87, 236.

Surveys.

Examination ordered by act of June 14, 1880. Made under direction of Maj. Benyaard, 1881, '82, 1565.

BIG HATCHIE RIVER, TENN.—IMPROVEMENT OF.**Appropriations.**

1880 \$10,000, '80, 1330.
 1881 3,500, '81, 1415.
 1882 3,000, '82, 1555.
 1884 2,500, '85, 1528.
 1886 3,000, '86, 1366.

Total 22,000

1888 5,000, act of August 11, 1888.

Statement of appropriations, '87, 1481.

Commerce.

Commerce obstructed by bridges without draws, '80, 1331.

Advantages arising from improvement, '80, 1330, 1331; '85, 1527.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 156; '81, 210; '82, 207; '83, 216; '84, 225; '85, 242; '86, 236; '87, 201.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1880-'82. Reports, '80, 1330; '81, 1415; '82, 1555.

Maj. A. M. Miller, 1882-'84. Reports, '83, 1153; '84, 1337.

Capt. E. Bergland, 1884-'86. Reports, '85, 1527; '86, 1366.

Capt. J. H. Willard, 1886-'—. Report, '87, 1479

BIG HATCHIE RIVER, TENN.—Continued.**Engineers—Continued.****ASSISTANTS.**

J. Burney. Report, '80, 1331.

J. J. Barry. Report, '85, 1528.

Legislation.

Act of State legislature declaring the river a navigable one, '80, 1331.

Operations.

1880-'81. By hired labor, 376 snags and 2,409 logs were removed and 16,243 trees cut down. River worked over from Bolivar to its mouth, '81, 1415.

1881-'82. 3,204 snags and logs removed, 636 trees cut down, and 1 wreck removed.

River worked over from Bolivar to its mouth, '82, 1555.

1882-'83. 1,431 snags and logs removed and 679 trees cut down; 185 miles of river worked over, '83, 1154.

1883-'84. No operations for lack of funds, '84, 1337.

1884-'85. 969 logs and snags removed and 1,094 trees cut down; 50 miles of river worked over, '85, 1528.

1885-'86. No operations on account of high water, '86, 1366.

1886-'87. 2,067 snags, stumps, and logs removed, 3,813 trees cut, and 3 cut-offs cleaned, '87, 1480.

Private and Corporate Work.

Obstruction of river by bridges without draws, '80, 1331, 1332.

Projects.

By Maj. Benyaud, 1879, for the removal of snags, leaning trees, and logs from Bolivar to its mouth, a distance of 240 miles; estimated cost, \$30,000, '80, 1331, 1342; '87, 1479.

Surveys.

Made under direction of Maj. Benyaud, 1879, '80, 1330.

BIG HOCKING RIVER, OHIO—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 244.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '87, 1835.

ASSISTANT.

Lieut. L. H. Beach. Report, '87, 1835.

Plans.

Lieut. Col. Merrill reports the locality as worthy of improvement and requiring no survey for an estimate of cost of same, '87, 1835.

Surveys.

From its mouth to Coolville. Examination ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Merrill, '87, 1835.

BIG RAPIDS, ME. (See ST. JOHN'S RIVER.)**BIG SANDY RIVER, W. VA. AND KY.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 500.)

Appropriations.

1878-'79	\$24,000
1880	55,000, '80, 1829.
1881	50,000, '81, 1982.
1882	25,000, '82, 259.
1884	50,000, '84, 1751.
1886	30,000, '86, 1619.

Total	234,000
1888	31,500, act of August 11, 1888.

BIG SANDY RIVER, W. VA. AND KY.—Continued.**Contracts.**

1883. D. B. Shipley, for delivery of stone for lock, '84, 1749.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 196; '81, 264; '82, 258; '83, 266; '84, 265, 267; '85, 290; '86, 284; '87, 241, 249.

ENGINEERS IN CHARGE.

Lieut. Col. W. E. Merrill, 1875-'80. Report, '80, 195.

Maj. J. W. Cuyler, 1840-'83. Reports, '80, 1827; '81, 1979; '82, 1952; '84, 1755.

Capt. J. C. Post, 1883-'87. Reports, '83, 1564; '84, 1749; '85, 1884; '86, 1618; '87, 1902.

Lieut. Col. W. E. Merrill, 1887-'—. Report, '87, 1823.

ASSISTANTS.

E. A. Chase. Reports, '80, 1829; '81, 1982; '82, 1953; '83, 1567.

B. C. Howell. Report, '84, 1751.

B. F. Thomas. Reports, '85, 1886; '87, 1824.

Operations.

1879-'80. Logs, snags, fallen trees, loose and solid rock removed by hired labor, '80, 1827, 1830.

1880-'83. Obstructions removed by hired labor, '81, 1984; '82, 1954; '83, 1564, 1569; summary of results accomplished, '83, 1555. This improvement of the natural channels has resulted in a channel 50 feet wide and 2 feet deep from Louisa, 100 miles up the Louisa Fork, and a similar channel in Tug Fork for a distance of 108 miles, '83, 1565.

1883-'84. Obstructions removed by hired labor from 36 miles of Louisa Fork; 2,768 cubic yards of stone for lock delivered; 2,132 cubic yards rock and 1,623 cubic yards of earth removed from foundation of lock, '84, 1750, 1751.

1884-'85. Obstructions removed by hired labor from 26 miles of the Big Sandy, 87 miles of Louisa Fork, and 58 miles on Tug Fork; excavation at lock site and completion of nearly two-thirds of the lock masonry, '85, 1885.

1885-'86. Completion of masonry for lock, '86, 1618.

1886-'87. Progress on foundation for abutment and excavation of the approaches to the lock, 1,603 trees and snags and 6,608 cubic yards of rock removed from Louisa and Tug forks, '87, 1823, 1825.

Plans.

By Lieut. Col. Merrill, 1878, for the improvement of the natural channels; to better the raft and push boat navigation, to be followed by a slack-water navigation; to afford a permanent 5-foot navigation by means of locks and dams; at estimated cost of \$1,937,536, '75, i, 757; '79, 1355.

In 1880 Maj. Cuyler proposed the construction of the first lock and dam at Louisa, Ky., at an estimated cost of \$110,000, '80, 1828; '81, 1981.

In 1883 this estimate is increased to \$213,237.39, '83, 1565.

In 1883 Maj. Cuyler did not consider the Louisa Fork worthy of improvement nor the work a public necessity, '84, 1756.

In 1887 Maj. Post considered that at a cost of \$5,750 the Louisa Fork could be improved from the Virginia State line to Dismal Swamp, so as to improve the rafting facilities by the removal of snags and rock, '87, 1902.

Private and Corporate Work.

Work done by State of Kentucky, '81, 1980.

Projects.

By Lieut. Col. Merrill, 1878, for the improvement of the natural channel, to afford a better raft and push-boat navigation; estimated cost, \$15,000, '80, 1828.

In 1880 modified by the construction of a lock and dam at Louisa, Ky., at estimated cost of \$60,000, '80, 1828.

Increased by Capt. Cuyler, 1881, to \$110,000, '81, 1981. Increased by Capt. Post, 1883, to \$213,237.39, '83, 1566.

From 1878 to 1886 \$234,000 was appropriated.

In 1887 it was estimated that \$62,645.31 would be required to complete the project, '87, 1824.

Surveys.

Localities improved, '81, 1980.

Examination of the upper part of Louisa Fork of Big Sandy River. Made, 1883, under direction of Maj. Cuyler, '84, 1755.

Examination of Louisa Fork ordered by act of August 5, 1886. Made under the direction of Capt. Post, '87, 1902.

BIG STONE LAKE AND LAKE TRAVERSE, MINN.—EXAMINATION WITH A VIEW TO THEIR CONNECTION.

(See also MINNESOTA RIVER.)

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 296.

ENGINEER IN CHARGE.

Maj. C. J. Allen. Report, '85, 1951.

Physical Characteristics.

Description of locality, '85, 1951.

Plans.

Maj. Allen considered that the desired connection between the lakes would require the construction of a canal and lock, at an estimated cost of \$400,000, and does not think the improvement worthy of being done by the General Government, '85, 1953.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Allen, '85, 1971.

BIG SUNFLOWER RIVER, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 531.)

Appropriations.

1879.....	\$20,000
1880.....	8,000, '80, 1318.
1881.....	4,000, '81, 1411.
1882.....	5,000, '82, 1549.
1884.....	5,000, '84, 1335.
1886.....	5,000, '86, 1359.
Total	47,000
1888.....	5,000, act of August 11, 1888.

List of appropriations, '86, 1359; '87, 1478.

Commerce.

Advantages resulting from improvement, '85, 1511.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 155; '81, 208; '82, 206; '83, 214; '84, 224; '85, 238; '86, 234; '87, 200.

ENGINEERS IN CHARGE.

Maj. W. H. Benyaurd, 1878-'82. Reports, '80, 1316; '81, 1408; '82, 1548.

Maj. A. M. Miller, 1882-'85. Reports, '83, 1145; '84, 1334; '85, 1511.

Capt. E. Bergland, 1883-'86. Report, '86, 1359.

Capt. J. H. Willard, 1886-'— . Report, '87, 1477.

ASSISTANTS.

J. M. Searles. Report, '80, 1316.

J. J. Barry. Reports, '81, 1409; '82, 1549; '83, 1146.

C. W. Phifer. Report, '85, 1512.

Operations.

1879-'80. 10 wing-dams built by hired labor at Olephant Bar; removal of snags and logs, '80, 155, 1316.

1880-'81. 472 snags and logs removed and 7,000 trees cut down; wing-dams built at Callao and Vick's Landing, '81, 1408.

1881-'82. 20,245 trees cut down, 186 logs removed, 775 linear feet wing-dams built at Callao, Shell Ridge, and Vick's Landing, '82, 1548.

1882-'83. 20,433 trees cut down, 3,109 logs and snags and 600 brush piles removed, '83, 1145.

1883-'84. No operations for lack of funds, '84, 1334.

1884-'85. 2,524 linear feet wing-dams built at Olephant, Callao, Woodburn, Johnsonville, and Hollywood; 400 logs and snags removed, '85, 1511, 1513.

1885-'86. No operations for lack of funds, '86, 1359.

1886-'87. 46 snags, stumps, and logs removed and 1,115 linear feet of wing-dams built, '87, 1478.

Physical Characteristics.

Description of river, '85, 1511.

BIG SUNFLOWER RIVER, MISS.—Continued.**Projects.**

By Maj. Benyaard, 1879, for improving the river to a depth of from 3 to 3½ feet by the removal of obstructions from the lower part of the river and the improvement of Elephant Bar and Muscle Shoals by wing-dams. Estimated cost, \$66,000, '79, 970; '86, 234.

Surveys.

1880. Elephant Bar and Muscle Shoal, '80, 1316.

BILOXI HARBOR, MISS.—IMPROVEMENT OF.**Appropriations.**

1882..... \$5,000, '83, 1029.
1886..... 12,500, '86, 1206.
1888..... 18,500, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 186; '83, 197; '84, 206; '85, 212; '86, 209; '87, 176.

ENGINEER IN CHARGE.

Capt. A. N. Damrell, 1882.—. Reports, '82, 1322; '83, 1029; '84, 1217; '85, 1360; '86, 1206; '87, 1333.

ASSISTANT.

T. L. Harrison. Report, '82, 1323.

Operations.

1884-'86. No operations on account of insufficiency of appropriations, '86, 1206.

1886-'87. Location of channel made, '87, 1333.

Projects.

By Maj. Damrell, 1881, for the deepening to 8 feet, by dredging, the channel between the wharves at Biloxi and deep water in Mississippi Sound. Estimated cost, \$35,000, '82, 1322, 1323. The work not considered susceptible of permanent improvement, '84, 1217. Estimate increased in 1885 to \$55,000, '85, 1361.

Surveys.

Ordered by act of March 3, 1881. Made under the direction of Maj. Damrell, 1881, '82, 1322.

BISSELL'S COVE, R. I.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS:**

Report, '84, 99.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '84, 663.

Plans.

The improvement desired was a channel 6 feet deep and 60 feet wide between Narragansett Bay and the wharves, a distance of 1,200 yards. Maj. Barlow considered it doubtful whether the work constituted a public necessity, '84, 663.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Barlow, '84, 663.

BLACK LAKE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 66.)

Appropriations.

1852-79.....	\$217,615.31
1880.....	6,000.00 '80, 2026.
1881.....	6,000.00 '81, 2231.
1882.....	10,000.00 '82, 2312.
1884.....	15,000.00 '84, 1989.
1886.....	5,000.00 '86, 1769.
Total	259,615.31
1888.....	5,000.00, act of August 11, 1888.

BLACK LAKE HARBOR, MICH.—Continued.**Commerce.**

Statistics, '81, 2232; '82, 2313.

Contracts.

1882. Dewar & Wing, for crib construction, '83, 1826. Contract modified to repair of piers, '83, 1827.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 217; '81, 295; '82, 289; '83, 297; '84, 298; '85, 320; '86, 314; '87, 282.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80. Report, '80, 214.

Maj. F. Harwood, 1880-'82. Reports, '80, 2026; '81, 2030.

Maj. D. P. Heap, 1882-'83. Report, '82, 2312.

Capt. D. W. Lockwood, 1883-'— . Reports, '83, 1826; '84, 1987; '85, 2083; '86, 1768; '87, 2194.

Operations.

1879-'80. 2 cribs placed in extension of north and south piers, '80, 2026.

1880-'81. Construction of catch-sand fences and repair of piers by hired labor; 1,560 cubic yards sand dredged from entrance channel by United States dredge, '81, 2231.

1881-'82. 1,042 linear feet catch-sand fence built and repair of piers by hired labor; 9,330 cubic yards dredged from channel by United States dredge, '82, 2312.

1882-'83. Repair of piers, '83, 1827.

1883-'84. 460 linear feet superstructure; north pier rebuilt by hired labor. Material furnished under contract with Dewar & Wing, '84, 1988.

1884-'85. Repairs to piers by hired labor, '85, 2083.

1885-'86. Repairs to piers by hired labor, '86, 1769.

1886-'87. No operations, '87, 2195.

Projects.

The projects of 1866 and 1873 proposed the formation of a channel of entrance of navigable width and not less than 12 feet deep, by pier extension and dredging. Estimated cost in 1866, \$106,238.04, '66, iv, 104, '83, 1827. From 1852 to 1884, \$238,673.23 had been expended and had resulted in obtaining a channel of entrance 9 feet deep, '84, 1988, 1989.

In 1883 Capt. Lockwood proposed placing an additional crib 50 feet long at the outer end of each pier, and completing the repairs to the piers at an estimated cost of \$35,000, '84, 1989.

BLACK RIVER, ARK. AND MO.—IMPROVEMENT OF.

(Continued from Vol. I, p. 69.)

Appropriations.

1880.....	\$15,000, '80, 1326.
1881.....	6,000, '81, 1517.
1882.....	10,000, '82, 1585.
1884.....	20,000, '84, 231.
1886.....	5,000, '86, 1377

Total 56,000

1888, Black River, Ark. and Mo.... { \$5,000, act of August 11, 1888.
7,000.

Commerce.

Decline in commerce, '84, 1403.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 156, 158; '81, 218; '82, 215, 216; '83, 223; '84, 231; '85, 247; '86, 240; '87, 208.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1879-'81. Reports, '80, 1326; '81, 1436.

Capt. T. H. Handbury, 1881-'83. Reports, '81, 1515; '82, 1583, 1584; '83, 1172.

Maj. M. B. Adams, 1883-'84. Report, '84, 1403.

Capt. H. S. Tabor, 1884-'—. Reports, '85, 1583; '86, 1377; '87, 1537.

Operations.

1880-'81. All operations carried on by hired labor; 1,350 linear feet of brush dam built at Devil's Tooth and Eagle's Nest Shoals; 556 snags and 586 trees removed, '81, 1436.

BLACK RIVER, ARK. AND MO.—Continued.**Operation—Continued.**

1881-'82. 971 snags and 3,100 trees removed. Closure of the "Chute" by brush dam, '82, 1584.
 1882-'83. 1,175 snags and 5,386 trees removed, '83, 1173.
 1883-'84. 1,429 snags and 2,480 trees removed, '84, 1403.
 1884-'85. 120 snags and 9,291 trees removed, '85, 1585.
 1885-'86. No operations for lack of funds, '86, 1317.
 1886-'87. 540 snags, 10,130 overhanging trees, and 4 drift piles removed; 16,004 trees deadened, '87, 1538.

Projects.

By Maj. Benyaard, 1879, for the improvement of the river between Poplar Bluff and White River by the removal of logs, snags, and trees, and construction of wing-dams. Estimated cost, \$80,800, '80, 1329.

In 1885 Capt. Tabor considered that an annual appropriation of from \$8,000 to \$10,000 would be required to keep the river available for navigation, '85, 247.

Surveys.

Ordered by act of March 3, 1879, '80, 158. Made under direction of Maj. Benyaard, 1879, '80, 1326.

BLACK RIVER FROM ITS MOUTH TO TRINITY, LA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 227.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1363.

Plans.

Capt. Miller did not consider the improvement of the river by cut-offs a public necessity or the river worthy of improvement, '84, 1363.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Capt. Miller, '84, 1363.

BLACK RIVER HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 70.)

Appropriations.

1879.....	\$175,204.77
1880.....	1,000.00, '80, 2132.
1881.....	7,000.00, '81, 2307.
1882.....	7,000.00, '82, 2397.
1884.....	10,000.00, '84, 2096.
1886.....	10,000.00, '86, 1862.

Total 210,204.77

1888..... 10,000.00, act of August 11, 1888.

Contracts.

1881. J. Stang, for construction of pile revetment, '81, 2308; modified in 1883 to cover repairs, '83, 1902. James Rooney, jr., for dredging, at 24 cents per cubic yard, '81, 2308.

1884. J. Stang, for pier repairs, '85, 2224. Stang & Gillmore, for dredging, at 21 cents per cubic yard, '85, 2224.

1886. Stang & Gillmore, for dredging, at 25½ cents per cubic yard, and repairs to piers, '87, 2313, 2315.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 226; '81, 309; '82, 303; '83, 311; '84, 314; '85, 339; '86, 333; '87, 299.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'82. Reports, '80, 2127; '81, 2306.

Maj. L. C. Overman, 1882-'— Reports, '83, 1902; '84, 2094; '85, 2223; '86, 1861; '87, 2312.

BLACK RIVER HARBOR, OHIO—Continued.**Operations.**

History of past operations, '80, 2127.

1879-'80. Repairs to piers by hired labor, '80, 2131.

1880-'81. Minor repairs to piers, '81, 2306.

1881-'82. 10,637 cubic yards dredged, 400 linear feet pile revetment built at inner end east pier, and minor repairs made to piers, '82, 2396.

1882-'83. Minor repairs to piers, 428 linear feet west pier superstructure removed, '83, 1903.

1883-'84. 693 linear feet of superstructure of west pier removed, 308 linear feet pile revetment at inner end east pier rebuilt, 138 linear feet of west pier superstructure repaired; minor repairs to both piers, '84, 2095.

1884-'85. 3,331 cubic yards dredged from channel, 656 linear feet of east pier superstructure removed, 262 linear feet pile revetment placed on channel side of west pier, and 225 linear feet of pile revetment placed on both sides of east pier, '85, 2224.

1885-'86. No operations for lack of funds, '86, 1861.

1886-'87. 3,994 cubic yards dredged from bar at entrance and repairs made to piers, '87, 2313.

Projects.

History of the work from 1828 to 1880, '80, 2131. Projects between 1828 and 1880 proposed by pier extension and dredging, the formation of a channel of entrance of navigable width, and not less than 14 feet deep. In 1880 an expenditure of \$175,138.92 had resulted in the formation of a channel not less than 15 feet deep, '80, 226, 2132. In 1880 Maj. Wilson proposed the extension of the piers to the 16-foot cams in the lake, with the renewal of 2,000 linear feet of old superstructure. Estimated cost, \$42,000, '80, 2131. Increased in 1882 to \$45,000, '82, 2397; increased in 1884 to \$64,000, on account of unexpected repairs, '84, 2096.

Surveys.

MAPS.

'81, 2308.

BLACK RIVER, MICH.—EXAMINATION OF MOUTH OF.

[§10,000 appropriated by act of August 11, 1888.]

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 294.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe, 1886. Report, '87, 2279.

Plans.

By Lieut. Col. Poe, 1887, for improvement of the river by removal of the shoal at its mouth to a uniform depth of 17 feet; estimated cost, \$69,300, '87, 2280.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Poe, '87, 2279.

BLACK RIVER, N. C.—SURVEY AND IMPROVEMENT OF.**Appropriations.**

1886..... \$3,000, '87, 1004.

Proviso of act of August 5, 1886, '87, 1043.

Commerce.

Justification of the improvement, '85, 1147; '87, 1043.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 177; '85, 177; '87, 130.

ENGINEERS IN CHARGE.

Capt. J. Mercur. Report, '84, 1061.

Capt. W. H. Bixby, 1884.—. Reports, '85, 1145, 1148; '87, 1042.

ASSISTANTS.

G. H. Elliott. Report, '84, 1061.

C. Humphries. Report, '85, 1157.

BLACK RIVER, N. C.—Continued.**Legislation.**

Act of the State of North Carolina incorporating the Black River Navigation Company, '85, 1153.

Repeal of State act, '87, 1043.

Physical Characteristics.

Description of river, '84, 1061; '85, 1146, 1149, 1151.

Plans.

In 1883 Capt. Mercur did not consider the work a public necessity or worthy of improvement, '84, 1061.

Projects.

By Capt. Bixby, 1884, to secure a thoroughly cleared natural channel over the 70 miles of river between its mouth and Lisbon, and afterwards a 4-foot low-water channel below Point Caswell. Estimated cost, \$33,500, '85, 1148; '87, 1043.

A part of the river controlled by a corporate company, whose rights should be ceded to the United States before expenditures are made, '85, 1149; '87, 1043.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Mercur, '84, 1061.

Survey made, 1884, under the direction of Capt. Bixby, '85, 1148.

BLACK RIVER, S. C.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 168.

ENGINEER IN CHARGE.

Capt. C. B. Phillips. Report, '81, 1040.

ASSISTANT.

C. W. Forster. Report, '81, 1041.

Physical Characteristics.

River described, '81, 1041.

Plans.

Capt. Phillips considers that there is literally no navigation, and no plan or estimate is submitted, '81, 1041.

Surveys.

From Kingston to its mouth, ordered by act of June 14, 1880, '80, 125. Made under direction of Capt. Phillips, '81, 1040.

BLACK ROCK HARBOR, CONN.—IMPROVEMENT OF.**Appropriations.**

1884.....	\$20,000, '85, 655.
1886.....	5,000, '86, 647.
1888.....	10,000, act of August 11, 1888.

Commerce.

Justification of the improvement, '84, 666, 669.

Contracts.

1885. J. A. Bouker, for construction of breakwater, at \$1.22 per ton of stone, '85, 654. H. & A. Beardsley, for dredging, at 15 cents per cubic yard, '85, 654.

1886. E. Brainard, for dredging, at 9 cents per cubic yard, '87, 613.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 99; '85, 86; '86, 87; '87, 49.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1883-'86. Reports, '84, 666; '85, 653.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 646; '87, 613.

ASSISTANT.

H. N. Babcock. Report, '84, 667.

BLACK ROCK HARBOR, CONN.—Continued.**Operations.**

1884-'85. 4,974 tons of stone placed in breakwater; 19,984 cubic yards dredged from Cedar Creek Channel, of which half the cost was paid by private parties, '85, 654.

1885-'86. 5,440 tons of stone placed in the breakwater, partially completing the work for the whole length, '86, 647.

1886-'87. 21,500 cubic yards dredged from Cedar Creek channel, '87, 613.

Physical Characteristics.

Description of harbor, '84, 668.

Private and Corporate Work.

Dredging in 1884-'85, by private interests, '85, 86, 654.

Projects.

In 1836-'38, \$21,550 expended in closing a breach across Fairweather Island, '85, 653.

By Lieut. Col. McFarland, 1883, for the construction of a riprap breakwater 2,700 feet long, extending from Fairweather Island to the mainland, and dredging a channel 3,300 feet long, 80 feet wide, and 6 feet deep at mean low water up Cedar Creek. Estimated cost, \$80,000, '84, 667, 668; '85, 653; '87, 613.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under the direction of Lieut. Col. McFarland, '84, 666.

MAPS.

Black Rock Harbor, '85, 654.

BLACK WARRIOR RIVER, FROM TUSCALOOSA TO DANIEL'S CREEK, ALA.—IMPROVEMENT OF.

(See **TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.**)

Appropriations.

1884..... \$50,000, '85, 1354.

1886..... 56,250, '86, 1200.

1888..... 100,000, act of August 11, 1888.

Below Tuscaloosa 18,000.

Commerce.

Justification of improvement, '80, 1219; '85, 1354.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 189; '85, 210; '86, 208; '87, 172.

BOARD OF ENGINEERS.

Convened by S. O. No. 9, C. of E., 1886, to consider the improvement of the Black Warrior River, Ala. Report, '87, 1302.

(Col. Craighill, Lieut. Col. Merrill, Majs. King, Damrell, and Post.)

ENGINEER IN CHARGE.

Maj. Damrell, 1879—. Reports, '81, 1218; '85, 1354; '86, 1199; '87, 1299.

ASSISTANT.

E. A. Smith. Report, '81, 1218.

Plans.

By Maj. Damrell, 1880, for slack-water navigation between Tuscaloosa and Forks of Sipsey and Mulbery, by means of locks and dams. Estimated cost, \$1,200,000, '81, 1218, 1220; '85, 1354; '86, 1199.

By Maj. Damrell, 1885, for a slack-water navigation between Tuscaloosa and Daniel's Creek, by means of movable locks and dams. Estimated cost, \$245,786, '85, 1354.

Projects.

By Board of Engineers, 1886, for a slack-water navigation between Tuscaloosa and Daniel's Creek, by means of locks and fixed dams. Estimated cost, \$567,000, '86, 1200; '87, 1300, 1301, 1303.

Surveys.

Ordered by act of March 3, 1879, '81, 189.

Made under direction of Maj. Damrell, 1879, '81, 1218.

BLACKWATER RIVER AND EAST BAY, FLA.—EXAMINATION OF.**Commerce.**

Benefit of improvement, '82, 1312.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1309.

ASSISTANT.

H. Haines. Report, '82, 1311.

Plans.

By Capt. Damrell, 1880, for the formation, by dredging, of a channel through the bars 100 feet wide and 9 feet deep at mean low water. Estimated cost, \$20,000, '82, 1310.

Surveys.

Ordered by act of March 3, 1879, '80, 141. Made, 1880, under direction of Capt. Damrell, '82, 1309.

BLACKWATER RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 72.)

Appropriations.

1878-'79	\$7,500
1880	3,500, '80, 822.
1881	1,500, '81, 992.
1882	1,500, '82, 1077.

Total 14,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 119; '81, 160; '82, 156; '83, 162; '84, 165; '85, 157; '86, 152; '87, 120.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'81. Report, '80, 821.

Capt. J. Mercur, 1881-'84. Reports, '81, 991; '82, 1077; '83, 843.

Capt. F. A. Hinman, 1884-'— . Reports, '84, 1031; '85, 1033; '86, 961; '87, 987.

Operations.

All operations by hired labor.

1879-'80. Removal of wreck, 161 snags, and 205 trees; also 54,110 cubic yards dredged from bar at mouth and George's Bend, '80, 822.

1880-'81. 18,000 cubic yards dredged at Franklin and Littletown Bend, and 90 linear feet of revetment built at Franklin, '81, 992.

1881-'82. No operations, '82, 1077.

1882-'83. Dredging at Littletown Bend, '83, 843.

1883-'84. Removal of 515 snags, logs, and trees, '84, 1031.

1884-'87. No operations for lack of funds, '85, 1033; '86, 961; '87, 987.

Projects.

By S. T. Abert, U. S. C. E., 1875, for dredging and the removal of snags and trees from the mouth to Franklin. Estimated cost, \$14,850, '75, ii, 162; '87, 120.

BLACK ISLAND HARBOR, R. I.—IMPROVEMENT OF.

(Continued from Vol. I, p. 73.)

Appropriations.

1870-'76	\$285,000
1880	6,000, '80, 390.
1882	19,000, '82, 562.
1884	15,000, '84, 628.
1886	20,000, '86, 612.

Total 345,000

1888..... 15,000, act of August 11, 1888.

BLOCK ISLAND HARBOR, B. I.—Continued.**Commerce.**

Increase of commerce, '82, 85.

Value of harbor, '85, 611.

Contracts.

1880. McDermott & Daly, for dredging, at 28 cents per cubic yard, '81, 563.

1883. C. H. Edwards, for granite riprap, at \$1.89 per ton, '83, 496. J. Scully, for building harbor wall, '83, 496.

1884. J. Scully, depositing riprap in breakwater gap, at \$1.65 per ton, '85, 608.

1887. W. H. Molthrop & Co., for granite riprap for breakwater and enlargement of inner harbor, '87, 566.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 75; '81, 85; '82, 85; '83, 82; '84, 88; '85, 76; '86, 77; '87, 40.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1870-'82. Reports, '80, 390; '81, 563; '82, 562.

Lieut. Col. G. H. Elliot, 1882-'87. Reports, '83, 496; '84, 626; '85, 606, 610; '86, 609.

Maj. W. R. Livermore, 1887-'— Report, '87, 558.

ASSISTANT.

J. P. Cotton. Report, '80, 391.

Operations.

1879-'80. No operations, '80, 390.

1880-'81. Removal of wreck and dredging 16,146 cubic yards from inner harbor, '81, 563.

1881-'82. No operations, '82, 562.

1882-'83. Construction of jetty by hired labor and building harbor wall by contract, '83, 496.

1883-'84. Completion of sea-wall and jetty; repair of wharf at inner harbor, '84, 627.

1884-'85. 5,795 tons riprap placed in breakwater gap, '85, 608.

1885-'86. 2,376 tons riprap placed in breakwater gap; repairs to piers of inner harbor, '86, 611.

1886-'87. No operations, '87, 559.

Projects.

By Lieut. Col. Warren, 1880, for dredging inner harbor to depth of 9 feet with the removal of a wreck therefrom. Estimated cost, \$8,000, '80, 391, 392; completed, 1881, '81, 563.

By Lieut. Col. Warren, 1881, for the construction of a harbor wall on the east side of inner harbor and the construction of a jetty to protect harbor from the material washed from the southward and eastward. Estimated cost, \$19,000, '82, 563.

By Lieut. Col. Elliot, 1883, for replacing the timber cribs on north and west sides of inner harbor by walls of stone and for replacing south wharf by a retaining-wall, backed with earth. Estimated cost, \$30,000, '83, 497.

By Lieut. Col. Elliot, 1884, for closing gap 200 feet long in main breakwater, '85, 607.

By Lieut. Col. Elliot, 1885, for enlargement of inner harbor to an area of about 18½ acres. Estimated cost, \$46,129, '86, 611, 613.

Surveys.**MAPS.**

'80, 390; '85, 612.

BLOSSOM ROCK, CAL. (See SAN FRANCISCO HARBOR, CAL.)

BLUE BUCK BAR, TEX. (See SABINE PASS, TEX.)

BOGUE SOUND, N. C. (See BEAUFORT AND NEW RIVER, N. C.)

BOGUE SOUND, N. C., between New River and Beaufort. (See BEAUFORT AND NEW RIVER, N. C., EXAMINATION OF SOUND BETWEEN.)

BOONE FORK, KY. (See KENTUCKY RIVER.)**BOONVILLE, MO.—SURVEY AT.**

(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)

BOQUET RIVER, N. Y.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 330.

ENGINEER IN CHARGE.

Maj. W. McFarland. Report, '84, 2162.

ASSISTANT.

J. A. Gillespie. Report, '84, 2163.

Plans.

Maj. McFarland, 1883, in view of the small interests involved, did not consider the river worthy of improvement or the work a public necessity, '84, 2163.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. McFarland, '84, 2162.

BOSTON HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 76.)

Appropriations.

1828-79	\$1, 516, 663
1880	75, 000, '80, 346.
1881	100, 000, '81, 515.
1882	96, 500, '82, 513.
1884	5, 000, '84, 513.
1886	56, 250, '86, 570.

Total 1, 849, 413

1888 125, 000, act of August 11, 1888. |**Contracts.**

1879. New England Dredging Company, for dredging, at 74 and 33 cents per cubic yard, '80, 347.
1890. Moore & Wright, for dredging, at 39 cents per cubic yard, '81, 515, 516.
- Eastern Dredging Company, for dredging, at 37 cents per cubic yard, '81, 517.
1881. Eastern Dredging Company, for dredging, at 22 cents per cubic yard, '81, 518.
- R. Hamilton, for dredging, at 19 cents per cubic yard, '81, 518. Eastern Dredging Company, for dredging, at 37 cents per cubic yard, '82, 513, 519.
1882. Eastern Dredging Company, for dredging, at 23 cents per cubic yard, '82, 513, 519. H. W. Phillips, for rock removal, at \$90 per cubic yard, '82, 513. G. W. Townsend, for rock removal, at \$35 per cubic yard, '83, 454.
1883. J. McDermott, for dredging, at 39 cents per cubic yard, '83, 454.
1886. Bay State Dredging Company, for dredging in Fort Point Channel, at 15 cents per cubic yard, '87, 519.
1887. J. E. Chapman, for dredging in Boston Harbor, at 23 cents per cubic yard, '87, 519.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 69; '81, 73; '82, 73; '83, 68; '84, 75; '85, 63; '86, 63; '87, 26.

ENGINEERS IN CHARGE.

Col. G. Thom, 1871-'83. Reports, '80, 346; '81, 515; '82, 512; '84, 588.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 445; '84, 503, 589; '85, 502, 543, 545.

Maj. G. L. Gillespie, 1886-'— . Reports, '86, 564; '87, 511.

ASSISTANT.

H. F. Bothfield. Report, '85, 546.

BOSTON HARBOR, MASS.—Continued.**Operations.**

- 1879-'80. 146 cubic yards rock removed from Kellogg's Ledge; 39,917 cubic yards dredged from Man-of-War Shoals; 21,054 cubic yards dredged from Anchorage; 47,953 cubic yards dredged from Mystic River; sea-wall repaired, '80, 347.
- 1880-'81. 30,409 cubic yards dredged from Anchorage Shoals; 5,007 cubic yards dredged from Low Middle Shoals; 33,114 cubic yards dredged from Charles River; 48,343 cubic yards dredged from Mystic River; 21,924 cubic yards dredged from Nantasket Beach Channel; sea-walls repaired, '81, 516.
- 1881-'82. 63,453 cubic yards dredged from Anchorage Shoals; 48,530 cubic yards dredged from Mystic River; 29,885 cubic yards dredged from Charles River; 19,998 cubic yards dredged from Nantasket Beach Channel; sea-walls repaired, '82, 513, 519.
- 1882-'83. 40,327 cubic yards dredged from Anchorage Shoals; 33,490 cubic yards dredged from Mystic River; 12,500 cubic yards dredged from Charles River; 50 cubic yards rock removed from Nantasket Beach Channel; sea-walls repaired, '83, 447.
- 1883-'84. 19,990 cubic yards dredged from Nick's Mate Channel; 31,950 cubic yards dredged from Castle Island Shoal; 57,631 cubic yards dredged from Charles River; sea-walls repaired, '84, 504.
- 1884-'85. Repairs to sea-walls and survey of part of the lower harbor, '85, 63.
- 1885-'86. Repairs to sea-walls and survey of part of lower harbor, '86, 63. History of past operations, '86, 567.
- 1886-'87. 94,211 cubic yards dredged from Fort Point Channel; repair to eastern sea-wall at Lovell's Island and south and middle walls at Deer Island, '87, 512, 516.

Projects.

The improvements undertaken since 1866 were projected as the necessities of the harbor required, being in general conformity with the recommendations of the United States commissioners, whose labors terminated in 1866. The preservation of the principal headlands by permanent sea-walls; the widening to 600 feet and deepening to 23 feet at mean low water of the main ship-channel, with the removal of sunken rock and shoals in other parts of the harbor; the widening to 100 feet and deepening to 8 feet at mean low water of Hingham Harbor Channel; the opening of the channel at mouth of Mystic River to a width of 400 feet and a depth of 23 feet at mean low water. The opening of a channel from the mouth of Charles River to head of navigation, as follows: To Western Avenue Bridge a channel 200 feet wide and 7 feet deep at mean low water; from thence to Market Street Bridge a channel 80 feet wide and 6 feet deep; from thence to the head of navigation a channel 60 feet wide and 2 feet deep. The formation of a channel from the harbor to Nantasket Beach wharves 100 feet wide and 9½ feet deep at mean low water. The removal of rocks from the main channel, its borders, and approaches, '80, 345; '86, 502. To June 30 1887, there had been appropriated for this work since 1867 \$1,663,750, '87, 511. Estimated cost for completion of existing project, \$435,500, '87, 518.

- By Maj. Raymond, for the improvement of Fort Point Channel by dredging, so as to form a channel about 1½ miles in length, extending from the entrance to a point near the draw-pier of the Federal Street Bridge, the channel to be 175 feet wide and 23 feet deep at mean low water. Estimated cost, \$100,000, '85, 546, 548; '87, 516.

Surveys.

1884. Of lower part of harbor, '85, 504.
- Survey of Fort Point Channel ordered by act of August 2, 1882. Made under direction of Maj. Raymond, who reported that a survey had already been just made by the State of Massachusetts, '84, 588.
- Examination of Fort Point Channel ordered by act of July 5, 1884. Made under the directions of Maj. Raymond, '85, 545.

MAPS.

- Of Boston Harbor, '80, 348; '83, 454; '87, 517.
- Of Charles River Harbor, '84, 512.
- Of channel between Nix's Mate and Long Island, '87, 517.

BOUGUE CHITO RIVER, MISS. AND LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

- Reports. '80, 146; '81, 197; '83, 212.

BOUGUE CHITO RIVER, MISS. AND LA.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Maj. A. Stickney. Report, '83, 1133.

ASSISTANT.

H. C. Collins. Report, '83 1133.

Plans.

Maj. Stickney considered that no improvement could be made, except at a cost incommensurate with benefits to be gained, '83, 1133.

Survey.

Ordered by act of June 14, 1880, '80, 146.

Made under direction of Maj. Stickney, '83, 1133.

BOUGUE FALIA RIVER, LA.—EXAMINATION OF.

(See also TCHUFUNOTE, LA.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '84, 216.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '84, 1283.

ASSISTANT.

H. C. Collins. Report, '84, 1284.

Plans.

Maj. Stickney did not consider that the improvement above Covington could be made at any reasonable cost. Below Covington it might be improved by cut-off. Estimated cost, \$1,856, '84, 1283.

Survey.

Ordered by act of June 14, 1880, '80, 146.

Made under direction of Maj. Stickney, 1884, '84, 1283.

BRANDYWINE RIVER, DEL.—SURVEY OF.**Commerce.**

Justification of the improvement, '84, 881, 885.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 139.

ENGINEER IN CHARGE.

Lieut. Col. G. Weitzel. Report, '84, 879, 882.

ASSISTANTS.

E. A. Giesler. Report, '84, 880.

J. H. Dager. Report, '84, 833.

Physical Characteristics.

River described, '84, 883.

Plans.

By Lieut. Col. Weitzel, 1883, for the formation of a dredged channel from the mouth to Market Street Bridge, in Wilmington, from 50 to 100 feet wide and from 6 to 9 feet deep, at an estimated cost of \$96,525, '84, 883, 884.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Lieut. Col. Weitzel, 1882, '84, 879.

Survey made in 1883, '84, 882.

BRANFORD HARBOR, CONN.—SURVEY OF.**Commerce.**

Statement relating thereto, '84, 678, 679.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 99.

BRANFORD HARBOR, CONN.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. J. W. Barlow. Report, '84, 678.

Maj. W. McFarland. Report, '84, 679. .

ASSISTANT.

H. N. Babcock. Report, '84, 680.

Plans.

Maj. McFarland, in 1883, did not consider that the commerce of the port justified the expenditure of \$78,000, which would be required to form a channel 100 feet wide and 9 feet deep through the shoal areas in the harbor, '84, 679, 680.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Maj. Barlow, '84, 678.

Survey made under direction of Maj. McFarland, '84, 679.

BRAZOS RIVER, TEX.—IMPROVEMENT OF MOUTH OF.

(Continued from Vol. I, p. 80.)

Appropriations.

1880.....	\$40,000, '80, 1244.
1881.....	40,000, '81, 1350.
1882.....	50,000, '82, 1462.
1884.....	10,000, '84, 1310.
1886.....	18,750, '86, 1328

Total 158,750

Commerce.

Justification of improvement, '81, 1350.

Contracts.

1881. Kanters & Son, for jetty construction, '81, 1347. G. L. Long, for jetty construction, '82, 1461.

1882. R. Moore, for jetty construction, '83, 1087.

1884. F. A. Brock, '85, 1461.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 148; '81, 201, 1351; '82, 198; '83, 203; '84, 218; '85, 228; '86, 225; '87, 191.

BOARD OF ENGINEERS.

Permanent Board on river and harbor improvement. Report of, '81, 1352. (See PROJECTS.)

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1874-'80, '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1242; '81, 1347; '82, 1460; '83, 1087; '84, 1309; '85, 1460; '86, 1327.

Maj. O. H. Ernst, 1886-'— Report, '87, 1427.

ASSISTANTS.

J. M. Picton, '82, 1462.

H. C. Ripley. Report, '87, 1428.

Operations.

1880-'81. Partial construction of 742½ linear feet of north channel jetty, '81, 1348.

1881-'82. Work on north jetty in progress, under contracts with Kanters & Son and G. L. Long, '82, 1461.

1882-'83. Work in progress on north and south jetties, under contract with R. Moore, '83, 1088.

1883-'84. No operations for lack of funds, '84, 1310.

1884-'85. Work in progress on north jetty, under contract with F. A. Brock, '85, 1461.

1885-'86. No operations for lack of funds, '86, 1328. The north jetty has been partly completed throughout a length of 2,433 linear feet. The south jetty foundation course laid for 700 feet, '86, 1327.

1886-'87. No operations pending a consideration of revised plans of improvement. '87, 191.

Physical Characteristics.

Slight tides in river, '81, 1349, 1353.

BRAZOS RIVER, TEX.—Continued.**Projects.**

By Maj. Howell, 1872, for the improvement of channel over the bar at mouth of river by means of two converging pile-jetties, each five-eighths of a mile long and 400 feet apart at their outer ends. Estimated cost, \$236,484, '75, i, 938, 941; '80, 1243.

The work not considered susceptible of permanent completion, '80, 1244.

By Maj. Mansfield, 1880, for parallel jetties, terminating in 18 or 20 feet of water, jetties to consist of brush, stone, and concrete; their direction to be chosen so as to fix the channel in its natural position. Approximate length of north jetty, 3,600 feet; of south jetty, 4,350 feet. Estimated cost, \$522,890.44, '81, 1349.

Recommended by Board of Engineers, '81, 1355. Concurred in by Chief of Engineers and approved by Secretary of War, '81, 1352.

In 1887 the \$140,833 expended had not resulted in any useful effect upon the bar. The plan for improvement to receive further consideration, '87, 191.

BRAZOS SANTIAGO HARBOR, TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 81.)

Appropriations.

1878.....	\$6,000
1880.....	25,000, '80, 1273.
1881.....	75,000, '81, 1367.
1882.....	60,000, '82, 1477.
1884.....	25,000, '84, 1318.
1886.....	37,500, '86, 1335.

Total 228,500

1888..... 25,000, act of August 11, 1888.

Contracts.

1881. G. L. Long, for jetty construction, '82, 1476.

1883. R. Moore, for jetty construction, '84, 1317.

1884. R. Moore, for jetty construction, '85, 1469.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 149; '81, 203, 204; '82, 200; '83, 205; '84, 220; '85, 229; '86, 226; '87, 192.

BOARD OF ENGINEERS.

For river and harbor improvements. Report, '82, 1489. (See PROJECTS.)

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1870-'80. Report, '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1272; '81, 1365; '82, 1475, 1480; '83, 1094; '84, 1316; '85, 1468; '86, 1334.

Maj. O. H. Ernst, 1886-'—. Report, '87, 1433.

ASSISTANTS.

H. C. Ripley. Reports, '81, 1367; '82, 1477, 1482.

J. G. Wright. Report, '83, 1095.

Lieut. W. L. Fisk. Report, '84, 1318.

Operations.

1881-'82. Construction of south jetty commenced and 495 linear feet partly completed, '82, 1476.

1882-'83. Work in progress over 2,300 linear feet of south jetty. Delay from yellow fever, '83, 1095.

1883-'84. Work in progress on south jetty; total length of 3,500 feet, '84, 1317; '85, 1468.

1884-'85. Work in progress on south jetty; total length of 3,500 feet, '85, 1468; '86, 1334.

1885-'86. No operations for lack of funds, '86, 1335.

1886-'87. Survey of harbor in progress, '87, 1433.

Physical Characteristics.

Description of pass, '81, 1368; '82, 1489.

Gradual filling of harbor, '81, 1369.

Small rise of tides, '82, 1490.

BRAZOS SANTIAGO HARBOR, TEX.—Continued.**Projects.**

By Maj. Mansfield, 1881, for deepening the channel across the bar and the maintenance of a suitable harbor inside the pass by the construction of two parallel jetties at the mouth of the river, extended to the 12-foot curve, and a dam from Point Isabel to Brazos Santiago, closing the lagoon, the south jetty to be 3,630 feet and the north jetty 2,940 feet long. Estimated cost, \$678,084.50, '81, 1367, 1372; '82, 1478, 1481, 1489, 1490; '86, 1334.

Approved by Board of Engineers, 1881, so far as the application of available funds to construction of south jetty will permit, '82, 1490; '86, 1335; '87, 1433.

Surveys.

From Brazos Santiago to Point Isabel, ordered by act of March 3, 1881, '81, 204. Made under direction of Maj. Mansfield, 1882, '82, 1477.

MAPS.

'82, 1478; '84, 1316.

BREAKWATER AT CLEVELAND, OHIO (See CLEVELAND, OHIO, BREAKWATER AT.)**BREAKWATER AT MACKINAC, MICH.** (See MACKINAC BREAKWATER, MICH.)**BREAKWATER AT NEW HAVEN, CONN.** (See NEW HAVEN, CONN., BREAKWATER AT.)**BRETON BAY, MD.** (See LEONARDTOWN HARBOR (Breton Bay), MD.)**BRIDGING THE NAVIGABLE WATERS OF THE UNITED STATES** (See also TOPICAL INDEX. Subject: *Bridges, and bridges at special localities.*)

(Continued from Vol. I, p. 83.)

General Considerations.

Of navigation through bridges over Upper Mississippi River, '82, 1979.

Power of Congress to protect navigation, '82, 1980.

Necessity for changes in laws relating to bridges across the Ohio River, '82, 1813, 2002.

General considerations at special localities, '80, 199, 1849; '81, 267, 2009; '82, 262, 1989; '83, 271, 1591; '84, 269, 1769; '85, 292, 1917; '86, 369, 2111; '87, 337, 2613.

Legislation.

Necessity of legislation relating to bridges over the Upper Mississippi River, '82, 1979.

Consideration of a proposed act to prescribe the dimensions of bridges across the Ohio River, '82, 2001.

Defects in present laws relating to bridges across the Ohio River, '82, 2008.

Amendatory act proposed for Ohio River, '82, 2010.

Necessity for general law applying to bridges over navigable waters, '82, 1813.

Commerce.

Power of Congress to protect, '82, 1980. List of bridges on Upper Mississippi which impede commerce, '82, 1981.

Importance of coal interests on the Ohio River and the requirements of its commerce, '82, 2005.

Obstruction to navigation on Chippewa River, Wis., from existing bridges, '82, 1811.

BRIDGE at Arthur Kill—STATEN ISLAND SOUND.**Legislation.**

Bridge authorized by act of June 16, 1886, '87, 337.

Plans.

Description of plans proposed, '87, 2635.

Engineers.**BOARD OF ENGINEERS.**

Report of Board of 1886, '87, 2632.

CHIEF OF ENGINEERS.

Report, '87, 337, 2637.

Commerce.

Dimensions of tows, '87, 2633.

Height of vessel masts, '87, 2634.

BRIDGE at Beaver, Pa.—ACROSS THE OHIO RIVER.

(Continued from Vol. I, p. 84.)

Legislation.

Executive requirements, '80, 199, 1849; '87, 2655.

Plans.

Railroad company required to build in connection with the bridge a dike for the protection of navigation, '80, 199, 1849. Maj. W. E. Merrill reports that such dike has not been built, '80, 1849. Department of Justice decides that the United States is powerless to compel railroad company to build dike, '80, 1552. Subsequent changes of opinion, '84, 1787, 1788; '87, 2655.

Board of Engineers convened in 1883 to examine questions at issue with a view of avoiding legislation, '84, 269. The Board consider the bridge as now built is an obstruction to navigation, but failed to effect satisfactory arrangements with the company for the correction of the evil, '84, 1786; '87, 2655. (Lieut. Cols. Craighill and Weitzel and Maj. Mackenzie.)

Engineers.

Chief of Engineers. Reports, '80, 199, 1849; '84, 269, 1787; '87, 338, 2659.

BRIDGE between Belle Isle and the American shore — ACROSS DETROIT RIVER.**Commerce.**

Conservation of navigable waters by the United States, '85, 202, 1918.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 292, 1918.

BRIDGE at Cairo, Ill.—ACROSS THE ILLINOIS RIVER.**Legislation.**

Act authorizing the bridge, '86, 370.

Plans.

Plan proposed by bridge company considered inadmissible by Board of Engineers, '86, 2127. Recommendations of the Board of Engineers, '86, 2127. Concurred in by the Chief of Engineers.

Engineers.**BOARD OF ENGINEERS.**

Board report adversely to a draw and recommend a clear headway of 53 feet above high water, '86, 2127. (Lieut. Cols. Abbot and Poe and Majs. Mackenzie and Allen.)

CHIEF OF ENGINEERS.

Report, '86, 369, 2127.

Commerce.

Dimensions of Ohio River steamers, '86, 2121. Protests of commercial interests against the bridge, '86, 2130.

BRIDGES at Camden and Pine Bluff, Ark.—ACROSS THE OUACHITA AND ARKANSAS RIVERS.

Legislation.

Bridge authorized by act of June 27, 1882, '83, 271.

Plans.

Description of, '83, 1605.

Location of bridge 10 miles below point specified in act of June 27, 1882, '83, 1606.

Bridges partly completed before passage of act, '83, 1607. Draw-span openings across Ouachita River only 110 feet in place of 139, as required, '83, 1607.

Recommended by Capt. T. H. Handbury, that the matter of the length of draw-bridge opening be allowed to remain in abeyance, '83, 1609. Approved by Secretary of War, '83, 1610.

Engineers.

CHIEF OF ENGINEERS.

Report, '83, 271, 1606.

BRIDGE at Charleston, W. Va.—ACROSS THE GREAT KANAWHA RIVER.

Legislation.

Changes recommended by Board of Engineers, '84, 1798, 1802.

Plans.

Col. W. P. Craighill considered that the channel-span should not be less than 250 feet clear opening, height of clear spans not less than 70 feet, '83, 1592.

Dimensions of spans referred to Board of Engineers, '84, 1797.

Recommendations of Board, '84, 1797.

Engineers.

BOARD OF ENGINEERS.

Recommend channel-span with clear opening of 400 feet and its lowest part at least 29 feet above the highest water and 75 feet above low water, '84, 1798. (Lieut. Cola. Craighill and Merrill and Capt. Post.)

CHIEF OF ENGINEERS.

Reports, '83, 271, 1591; '84, 271, 1796.

Commerce.

Requirements of commerce, '83, 1593; '84, 1804.

BRIDGE between Cincinnati, Ohio, and Covington, Ky.—ACROSS THE OHIO RIVER.

Legislation.

Bridge authorized by act of May 20, 1886, '87, 337.

Plans.

The Board of Engineers of 1886 disapproved the location of the bridge, '87, 337.

Approval of changed location and plan, '87, 337, 2631.

Engineers.

BOARD OF ENGINEERS.

Report of Board of 1886, '87, 2616, 2621.

CHIEF OF ENGINEERS.

Report, '87, 337, 2613.

BRIDGE at Detroit, Mich.—ACROSS THE CHANNEL BETWEEN LAKE HURON AND ERIE.

(Continued from Vol. I, p. 87.)

Plans.

Described and discussed by Board of Engineers, '80, 1854.

Engineers.

BOARD OF ENGINEERS.

Convened at Detroit October 14, 1879, '80, 1853. The Board consider a tunnel under the river the most satisfactory solution to the problem. If bridge is built it should be provided with a draw-span of not less than 300 feet. Fixed spans not less than 450 feet in the clear, with 60 feet headway, '80, 1855.

Maj. Wilson did not concur in plan of bridge with draw, '80, 1856. (Lieut. Cola. Reynolds and Michler, and Majs. Poe, Houston, and Wilson.)

BRIDGE at Detroit, Mich.—Continued.**Engineers—Continued.**

CHIEF OF ENGINEERS.

Report, '80, 199.

Commerce.

Statistics, '80, 1857, 1862.

BRIDGE at Dubuque, Iowa.—ACROSS THE MISSISSIPPI RIVER.

(Continued from Vol. I, p. 88.)

Legislation.

The act of March 3, 1875, fixed the width of the draw-span at 500 feet. By the act of May 29, 1884, this was reduced to 400 feet, '84, 271.

Plans.

Modifications in spans discussed by bridge company, '83, 1595, 1598. Recommended by Chief of Engineers, '83, 1598. Action of Congress necessary before modification can be made, '83, 1599.

Modified by act of May 29, 1884, '84, 271.

Engineers.

CHIEF OF ENGINEERS.

Reports, '83, 271, 1598; '84, 271.

BRIDGE near Fairmont, W. Va.—ACROSS THE MONONGAHELA RIVER.**Plans.**

Referred to Lieut. Col. Merrill for examination and report, '85, 293, 1920. Recommended that site and plans be approved, provided that one channel-span be arranged with opening of 220 feet and a clear height of 41½ feet, '85, 1922. Clear span reduced to 140 feet, '85, 1924, and the recommendation made and approved by Secretary of War that the bridge company be permitted to build at a less height than that above indicated, provided they will subsequently raise the bridge if required, '85, 1924.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 293, 1923.

BRIDGE at Fort Snelling, Minn.—ACROSS THE MISSISSIPPI RIVER.

(Continued from Vol. I, p. 89.)

Legislation.

Bridge authorized by act of June 30, 1878, '80, 199, 1869.

Plans.

Test of bridge assigned to Capt. C. J. Allen, '80, 200. Report of, '80, 1869.

Engineers.

BOARD OF ENGINEERS.

The Board approve of plan, '80, 200. (Gen. Terry and Col. Warren.)

CHIEF OF ENGINEERS.

Report, '80, 200.

BRIDGE (PROPOSED) at Georgetown, D. C.—ACROSS THE POTOMAC RIVER.**Legislation.**

Bridge authorized by act of February 23, 1881, Congress appropriating \$140,000 therefor, '82, 2012.

Purchase of Aqueduct Bridge authorized at \$85,000, but found to be impracticable, '82, 2012, 2018. Recommended legislation, '86, 931; '87, -99. Act of June 21, 1886, providing for purchase and reconstruction of bridge, '87, -99.

BRIDGE (PROPOSED) at Georgetown, D. C.—Continued.**Plans.**

Location discussed, '82, 2015, 2023.

Requirements of bridges, '82, 2024, 2027, 2033.

Proposals received, '82, 2023, 2026.

Estimates of cost, '82, 2032.

General description of Aqueduct Bridge completed in 1868, '86, 932; '87, 898.

Plans of new bridge, '87, 902-908.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 263, 2013; '87, 104, 905.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. C. E. Report, '82, 2014, 2022, 2027.

Lieut. Col. P. C. Haines. Report, '87, 898.

BRIDGE (AQUEDUCT) at Georgetown, D. C.—ACROSS THE POTOMAC RIVER.**Legislation.**

History of, '86, 931.

Senate resolution of February 25, 1886, calling for an examination of present condition of bridge and its safety when the aqueduct is filled with water, '86, 148.

Plans.

General description of, '86, 932.

Condition of bridge in 1886, '86, 933.

Repairs required, '86, 947.

Engineers.**CHIEF OF ENGINEERS.**

Report on condition of bridge in 1886, '86, 148; '87, 898.

BRIDGE at Hendersonville, Ky.—ACROSS THE OHIO RIVER.**Legislation.**

Bridge authorized by act of December 17, 1872, '82, 1990.

Plans.

Description of spans proposed, '82, 1891.

Changes in plan approved by Board of Engineers made without its approval, '86, 2136, 2139.

Modifications subsequently approved, '86, 2140.

Board of Engineers recommended plan submitted by railroad company for approval, '82, 1992.

(Lieut. Col. Comstock, Maja. Weitzel and Merrill.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 263, 1989; '86, 370, 2136, 2140.

Commerce.

Requirements of the Ohio River, '82, 1990.

BRIDGE at Keithsburg, Ill.—ACROSS THE MISSISSIPPI RIVER.**Legislation.**

Bridge authorized by act of April 26, 1882, '86, 369.

Plans.

After certain modifications the plan and location were approved by the Secretary of War, '86, 369, 2111.

Engineers.**CHIEF OF ENGINEERS.**

Report, '86, 369, 2111.

BRIDGE at Little Rock, Ark.—ACROSS THE ARKANSAS RIVER.

(Continued from Vol. I, p. 92.)

Legislation.

Bridge authorized by acts of July 1, 1870, and May 31, 1872, '81, 2010; '84, 270, 1789.

Plans.

Requirements of Congress, '81, 2010.

Plan as proposed by bridge company, '81, 2013.

Board of Surveyors convened at Little Rock. Board do not consider that the bridge as at present planned fulfills the requirements of commerce, '81, 2013.

Modifications recommended by Maj. M. B. Adams concurred in by the Chief of Engineers and approved by the Secretary of War, '84, 1790, 1791.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 267; '84, 270, 1789.

BRIDGE at Louisville, Ky.—ACROSS THE OHIO RIVER.

(Continued from Vol. I, p. 92.)

Legislation.

Bridge authorized by act of December 17, 1872, '82, 1986. Requirements of State of Ohio, '82, 1987.

Plans.

Modification of previous plans, '82, 1986.

Approval of plans by Board of Engineers, '82, 1988.

- Board of Engineers recommend that the plans adopted by railroad company be approved, '82, 1988.

(Lient. Col. Comstock and Majs. Weitzel and Merrill.)

Engineers.

CHIEF OF ENGINEERS.

Report, '82, 263, 1988.

BRIDGE near Merom, Ind.—ACROSS WARREN RIVER.**Legislation.**

Bridge authorized by act of June 30, 1879, '82, 263.

Plans.

Approval of, recommended by Chief of Engineers, '82, 2011.

Engineers.

CHIEF OF ENGINEERS.

Report, '82, 263, 2011.

BRIDGE (STONE ARCH) at Minneapolis, Minn.—ACROSS THE MISSISSIPPI RIVER.**Plans.**

An arch bridge of stone of 4 spans of 125 feet each, '86, 2112.

Engineers.

BOARD OF ENGINEERS.

Convened to consider the effect of such a bridge upon the works of the United States for the preservation of the Falls of Saint Anthony, '86, 2111.

The Board did not think these works would be jeopardized by the construction of the proposed bridge, '86, 2113.

(Lient. Col. Poe, Majs. Mackenzie and Allen.)

CHIEF OF ENGINEERS.

Report, '86, 369.

BRIDGE near New London, Conn.—ACROSS THAMES RIVER.**Legislation.**

Bridge authorized by act of March 3, 1883, '84, 269.

Plans.

The following modifications were recommended by Board of Engineers and approved by Secretary of War: The bridge to be raised so as to leave a clear height of 30 feet at high water; the draw to be provided with suitable pier rests; a steam fog-signal and suitable lights to be attached to the bridge, '84, 1770.

(Col. Newton, Lieut. Col. Elliot, and Maj. McFarland, U. S. Army, and Capt. Phythian and Commander Mahan, U. S. Navy.)

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 269.

BRIDGE of Northern Pacific R. R. Co.—ACROSS SAINT LOUIS RIVER, MINN. AND WIS.**Legislation.**

Bridge authorized by act of February 27, 1873, '85, 293. Requirements of act, '85, 1927.

Plans.

Reason for change in location proposed by railroad company, '85, 1925, 1927.

Plan described as proposed by railroad company, '85, 1929. Modifications recommended by Board of Engineers, '85, 1930.

Draw on Wisconsin side subsequently provided for, '85, 1935.

Engineers.

BOARD OF ENGINEERS.

Convened to consider and report upon plan and location of bridge, '85, 1928.

Board recommended approval of plans with following modifications: Omission of open span between the draw-span and Rice's Point, and that the company shall construct, whenever required, a draw near the Wisconsin shore, '85, 1930. (Lieut. Col. Poe, Majs. Mackenzie, and Allen.)

BRIDGE at Point Pleasant, W. Va.—ACROSS THE OHIO RIVER.**Plans.**

Coal exchange at Pittsburgh recommend change of location in piers proposed by the bridge company, '82, 2000. Modification accepted by company, '82, 2000.

Engineers.

BOARD OF ENGINEERS.

Recommended approval of plans provided channel-span is changed to position suggested by coal exchange, and that the lowest part of bridge be at least 40 feet above high water, '82, 2000.

(Lieut. Col. Comstock, Majs. Weitzel and Merrill.)

CHIEF OF ENGINEERS.

Report, '82, 263, 1998.

BRIDGE at Portland, Oregon—ACROSS THE WILLAMETTE RIVER.

(Continued from Vol. I, p. 95.)

Legislation.

State legislation, 1878, authorizing construction of bridge, '82, 2043, 2044; '87, 2669.

Plans.

General description of bridge proposed, '82, 2052, 2080.

Opposition to construction of bridges at location proposed, '82, 2044, 2046, 2058, 2068.

Construction of bridge commenced in 1880, '82, 2050. Width of spans considered inadequate and location of bridge improper, '82, 2064.

Action of Department of Justice toward protecting the rights of the United States, '82, 2067, 2072.

BRIDGE at Portland, Oregon—Continued.**Plans—Continued.**

Injunction granted against construction of bridge by United States circuit court, 1881, '82, 2082, 2094.

Petition in 1895 for construction of bridge, '85, 1918.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 263; '85, 292; '87, 339.

BOARD OF ENGINEERS.

Report, '87, 2663-2669.

Commerce.

Requirements of, on Willamette River, '82, 2046, 2047, 2051, 2056, 2083, 2091.

BRIDGE across the Eastern Branch of the Potomac River.**Appropriation.**

1887..... \$110,000, '87, 911.

Engineers.**BOARD OF ENGINEERS.**

Convened by S. O. No. 61, C. of E., 1887, to consider bridging the Eastern Branch of the Potomac River. Report, '87, 923.

(Lieut. Cols. Wilson and Hains and Maj. Lydecker.)

CHIEF OF ENGINEERS.

Report, '87, 105, 340, 917.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains. Report, '87, 911.

Projects.

Description of bridge, '87, 912, 915, 918, 924.

BRIDGE at Rouse's Point, N. Y.—ACROSS LAKE CHAMPLAIN.**Legislation.**

Bridge authorized by act of February 24, 1863, '83, 271.

Plans.

The Chief of Engineers recommends that the plans and location of the bridge be approved, '83, 1611.

BRIDGE at Sabula, Iowa—ACROSS THE MISSISSIPPI RIVER.**Legislation.**

Bridge authorized by act of April 1, 1872, '81, 268.

Plans.

Requirements of Congress, '81, 2015.

Maj. A. Mackenzie reports that the plans and location of bridge as proposed by the railroad company interfere as little as possible with the requirements of navigation, '81, 2016, 2018.

Engineers.**CHIEF OF ENGINEERS.**

Report, '81, 268, 2016.

BRIDGE at Saint Louis, Mo.—ACROSS THE MISSISSIPPI RIVER.**Engineers.****BOARD OF ENGINEERS.**

Report of Board of 1886. The Board was decidedly of opinion that a low bridge with a draw should not be authorized below the mouth of the Missouri River, '87, 338, 2638.

CHIEF OF ENGINEERS.

Report, '87, 338.

BRIDGE at Salem, Oregon—ACROSS THE WILLAMETTE RIVER.**Legislation.**

Bridge authorized by act of July 29, 1886.

Plans.

Bridge already built when plans were submitted for approval. The Board of Engineers consider that with slight modifications the bridge will not be a serious obstruction to navigation, '87, 339, 2687.

Engineers.

BOARD OF ENGINEERS.

Of 1887. Report, '87, 2683.

CHIEF OF ENGINEERS.

Report, '87, 339.

BRIDGE at Selma, Ala.—ACROSS THE ALABAMA RIVER.**Plans.**

It having been represented that the bridge was likely to create an obstruction to navigation a Board of Engineers was convened in 1886 to consider and report upon the question, '86, 370, 2136.

Engineers.

BOARD OF ENGINEERS.

The bridge considered an obstruction to navigation, and it was recommended that the bridge company be required to prepare a channel between pivot-span and north bank for the passage of boats at all stages exceeding a 24-foot stage, and in addition to provide such future facilities to navigation as may be required, '86, 2136.

CHIEF OF ENGINEERS.

Report, '86, 370, 2136.

BRIDGE at Shreveport, La.—ACROSS THE RED RIVER.**Plans.**

Formation of sand-bar under draw of bridge and obstruction to navigation. No action taken for its removal by bridge authorities, '87, 339, 2671.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 339, 2671.

BRIDGE of the Sioux City and Pacific R. R. Co.—ACROSS THE MISSOURI RIVER.

(Continued from Vol. I, p. 96.)

Legislation.

Bridge authorized by act of June 27, 1882, '83, 271.

Plans.

Maj. C. R. Suter considered that if the bridge is located and built as projected it will form no unnecessary obstruction to navigation, '83, 1603.

Engineers.

CHIEF OF ENGINEERS.

Report, '83, 271, 1603.

BRIDGE below Falls of Saint Anthony—ACROSS THE UPPER MISSISSIPPI RIVER.

(See BRIDGING THE NAVIGABLE WATERS OF THE UNITED STATES.)

BRIDGE at Van Buren, Ark.—ACROSS ARKANSAS RIVER.**Legislation.**

Bridge authorized by act of July 3, 1882, '84, 270.

Plans.

Plans as originally proposed were modified by the recommendations of a Board of Engineers. The railroad company objected to the changes. In 1884 the railroad company proposed to construct at its own expense any work which might subsequently be found necessary for the maintenance of navigation. The Chief of Engineers thereupon recommended the approval of original site, which was approved by the Secretary of War, '84, 270, 1792, 1796.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 270, 1792.

BRIDGE between Washington and Arlington, D. C.—ACROSS THE POTOMAC RIVER.

(Continued from Vol. I, p. 95.)

Legislation.

By Senate resolution of May 24, 1866, the Secretary of War was directed to examine into the expediency of constructing a Government bridge at this point, '86, 892.

Plans.

Description and estimates for proposed bridge, '86, 892, 894, 897.

Engineers.

CHIEF OF ENGINEERS.

Report, '86, 892.

BRIDGE at Wheeling, W. Va.—ACROSS THE OHIO RIVER.

(Continued from Vol. I, p. 98.)

Legislation.

Bridge authorized by act of December 17, 1872, '82, 1992. Supplementary act of February 14, 1883, '84, 1772.

Plans.

Description of span opening proposed by railroad company, '82, 1996.

Modifications and recommendations of the Board of Engineers, '82, 1997. Accepted by the bridge company, '82, 1998. Plans as modified approved by Board of Engineers, '84, 1776.

Engineers.

BOARD OF ENGINEERS.

Recommend modifications in plans submitted by the bridge company, '82, 1997.

Modifications made and approved by Board, '84, 1776.

(Lieut. Col. Comstock, Majs. Weitzel and Merrill.)

CHIEF OF ENGINEERS.

Reports, '82, 263, 1994; '84, 269, 1773.

BRIDGEPORT HARBOR, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 81.)

Appropriations.

1836-'79	\$175,000
1880	10,000, '80, 463.
1881	10,000, '81, 604.
1882	10,000, '82, 619.
1884	5,000, '84, 652.
1886	20,000, '86, 645.

Total 230,000

1888..... 10,000, act of August 11, 1888.

List of appropriations, '83, 520; '84, 652; '86, 645; '87, 611.

BRIDGEPORT HARBOR, CONN.—Continued.**Contracts.**

1879. H. N. & A. J. Beardsley, for dredging, at 15 cents per cubic yard, '80, 462.
 1880. H. N. & A. J. Beardsley, for dredging, at 10 and 20 cents per cubic yard, '81, 603.
 1881. H. N. & A. J. Beardsley, for dredging, at 10 cents per cubic yard, '81, 604.
 1882. H. Du Bois & Sons, for dredging, at $9\frac{1}{2}$ cents per cubic yard, '83, 521.
 1885. H. Du Bois & Sons, for dredging, at 7 $\frac{1}{2}$ cents per cubic yard, '85, 651.
 1886. A. J. Beardsley & Co., for dredging, at 5 $\frac{1}{2}$ cents per cubic yard, '87, 612.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 79; '81, 94; '82, 95; '83, 90; '84, 97; '85, 85; '86, 86; '87, 49.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 462; '81, 603; '82, 617.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 520; '84, 652; '85, 651.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 644; '87, 610.

Operations.

- 1879-'80. 89,417 cubic yards dredged, '80, 462.
 1880-'81. 70,703 cubic yards dredged, '81, 604.
 1881-'82. 90,000 cubic yards dredged, '82, 618.
 1882-'83. 90,561 cubic yards dredged, '83, 520.
 1883-'84. No operations for lack of funds, '84, 651.
 1884-'85. 59,352 cubic yards dredged, '85, 651.
 1885-'86. No operations for lack of funds, '86, 645.
 1886-'87. 261,960 cubic yards dredged from channel, '87, 610.

Projects.

The projects of 1871-75 proposed the formation of a channel of navigable width and 12 feet deep from Long Island Sound to the lower bridge, at estimated cost of \$138,000 for dredging; also a riprap jetty 1,390 feet long from Long Beach, at a cost of \$35,000, '80, 462. This work was completed in 1880 under aggregate appropriations amounting to \$195,000, when Maj. Barlow proposed the widening to 600 feet of the channel from the inner beacon to the steam-boat wharf. Estimated cost, \$80,000, '81, 604; '85, 651; '86, 644; '87, 610.

Surveys.**MAPS.**

'82, 618; '85, 652; '87, 612.

BROAD CREEK, DEL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 99.)

Appropriations.

1880.....	\$5,000, '80, 643.
1881.....	10,000, '81, 886.
1882.....	5,000, '82, 858.
1886.....	*10,000, '87, 844.

Total	30,000
1888.....	5,000, act of August 11, 1888.

Commerce.

Justification of improvement, '80, 642; '81, 885; '85, 880.

Contracts.

1881. G. W. Parsons, for dredging, at 23 $\frac{1}{2}$ cents per cubic yard, '81, 887.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 103, 110; '81, 139; '82, 135; '83, 138; '84, 145; '85, 130; '86, 128; '87, 95.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1880-'85. Reports, '80, 640; '81, 885; '82, 867; '83, 680; '84, 903.

W. F. Smith, U. S. Agent, 1885-'—. Reports, '85, 880; '86, 863; '87, 843.

ASSISTANTS.

J. L. Seager, '80, 640.

G. W. Pearsons. Report, '81, 887.

*Improving Nanticooke River, Del., '87, 843.

BROAD CREEK, DEL.—Continued.**Operations.**

1880-'82. Cut dredged about 7,000 feet long and 32 feet wide, '82, 857.

1882-'83. Continuation of dredging, '83, 680.

1883-'87. No operations, '84, 903; '85, 880; '86, 128; '87, 95.

Physical Characteristics.

Broad Creek described, '80, 641.

Projects.

By Lieut. Col. Craighill, 1880, for the formation of a channel 60 feet wide and 7 feet deep by dredging from its mouth to Laurel, supplemented by wing-dams and training-walls. Estimated cost, \$60,000, '80, 641.

In 1883 Col. Craighill considered, after an aggregate appropriation of \$20,000, that further dredging without regulating works would be useless and estimated that \$32,625 would be required for the completion of the project involving such regulating works, '83, 681.

Surveys.

Ordered by act of March 3, 1879, '80, 110. Made under direction of Lieut. Col. Craighill, 1880, '80, 640.

BROAD CREEK, MD.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 150; '82, 144.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '82, 948.

Plans.

By Col. Craighill, 1882, for the formation of a dredged channel 8 feet deep at mean low water and 150 feet wide on the west side of Kent Island; also an interior basin 800 feet square. Estimated cost, \$30,000, '82, 948.

Surveys.

Examination ordered by act of March 3, 1881. Made under the direction of Col. Craighill, '82, 948.

BROADKILN RIVER, DEL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 99.)

Appropriations.

1873-'79	\$10,000
1880	5,000, '80, 587.
1881	5,000, '81, 780.
1882	5,000, '82, 768.

Total 25,000

1888 10,000, act of August 11, 1888.

Statement of appropriations, '87, 834.

Contracts.

1885. The American Dredging Company, for dredging, at 12 cents per cubic yard, '86, 863.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 95; '81, 122; '82, 121; '83, 121; '84, 130; '85, 130; '86, 128; '87, 90.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1878-'81. Reports, '80, 587; '81, 780, 782.

Capt. W. Ludlow, 1881-'82. Report, '82, 768.

Lieut. Col. G. Weitzel, 1882-'84. Report, '83, 623.

Maj. W. H. Heuer, 1884-'85. Report, '84, 828.

W. F. Smith, U. S. Agent, 1885-'— . Reports, '85, 879; '86, 863; '87, 834.

ASSISTANTS.

J. H. Odiorne. Report, '83, 624.

J. M. Stewart. Report, '84, 828.

BROADKILN RIVER, DEL.—Continued.**Operations.**

1872-'85. Operations suspended.

1885-'86. 92,737 cubic yards dredged between mouth of river and Milton, Del., '86, 862.

1886-'87. No operations for lack of funds, '87, 834.

Projects.

By Col. Maccomb, 1881, for the formation of a river entrance below junction of Lewes and Broadkilkn Creeks, so as to obtain by dredging and construction of a deflecting jetty a channel 6 feet deep at mean low water. Estimated cost, \$51,500, '81, 782.

BROAD LYNN HAVEN AND LINK HORN BAYS, VA.—EXAMINATION OF.

(Continued from Vol. I, p. 99.)

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 125.

ENGINEER IN CHARGE.

Capt. C. B. Phillips. Report, '80, 900.

ASSISTANT.

F. W. Frost. Report, '80, 901.

Physical Characteristics.

The bays described, '80, 901.

Plans.

Capt. Phillips considered that it would be useless to attempt an improvement of the interior bays unless the project should include the improvement of entrance to Lynn Haven Bay, which would be too expensive to be warranted by the requirements of commerce, '80, 901.

Survey.

Ordered by act of March 3, 1879, '80, 125. Made under direction of Capt. Phillips, 1879, '80, 900.

BROAD RIVER, N. C.—EXAMINATION OF.

(See also BROAD RIVER, S. C.)

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 177.

ENGINEER IN CHARGE.

Capt. J. Mercur. Report, '84, 1058.

Plans.

Capt. Mercur, in 1883, did not consider the river worthy of improvement nor the work a public necessity, '84, 1058.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Mercur, '84, 1058.

BROAD RIVER, S. C.—EXAMINATION OF.

(Continued from Vol. I, p. 100.)

Commerce.

Justification of improvement, '80, 1011, 1013, 1026.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 132.

ENGINEER IN CHARGE.

Lieut. Col. G. A. Gillmore. Report, '80, 1010.

ASSISTANT.

J. P. Carson. Report, '80, 1013.

BROAD RIVER, S. C.—Continued.**Plans.**

By Col. Gillmore, 1880, for the formation of a channel for pole-boat navigation.
Estimated cost, \$90,000, '80, 1013.

Physical Characteristics.

Described, '80, 1014.

Survey.

Ordered by act of March 3, 1879, '80, 132. Made under direction of Col. Gillmore, 1880, '80, 1010.

BRONX RIVER, N. Y.—SURVEY OF.**Commerce.**

Statistics, '81, 665.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 108.

ENGINEER IN CHARGE.

Col. J. Newton. Report, '81, 666

ASSISTANT.

R. H. Talcot. Report, '81, 666.

Physical Characteristics.

Described, '81, 666.

Plans.

By Col. Newton, 1881, for improvement, by means of dredging and dikes, so as to obtain a channel from 30 to 50 feet wide and from 4 to 5 feet deep at mean low water. Estimated cost, \$136,275, '81, 666, 667.

Survey.

Ordered by act of June 14, 1880, '80, 85.

BROWNSVILLE, NEB. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**BRUNSWICK HARBOR, ME.** (See ANDROSCOGGIN RIVER.)**BRUNSWICK HARBOR, GA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 100.)

Appropriations.

1836-79	\$30,000
1880	10,000, '80, 963.
1881	5,000, '81, 1115.
1882	25,000, '82, 1182.
1884	10,000, '84, 1120.
1886	22,500, '86, 1116.

Total	102,500
1888	35,000, act of August 11, 1888.

Commerce.

Importance of improvement, '81, 1115, 1118; '83, 926; '86, 1115; '87, 1186.

Contracts.

1880. J. Brady, for jetty construction; J. E. Walter, for dredging, at 13½ cents per cubic yard, '80, 963.
1881. J. E. Walter, for dredging, at 24½ cents and 33½ cents per cubic yard, '81, 1116.
1882. J. E. Walter, for dredging, at 27 cents per cubic yard. J. C. Provost, for jetty construction, '83, 922, 923.
1884. J. S. Howell, for jetty construction, '85, 1225.

BRUNSWICK HARBOR, GA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 129; '81, 175; '82, 170; '83, 180; '84, 188; '85, 188; '86, 187; '87, 151.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1876'— Reports, '80, 959; '81, 1112; '82, 1178; '83, 919; '84, 1118; '85, 1224; '86, 1112; '87, 1184.

ASSISTANTS.

S. L. Tremont. Reports, '80, 964; '81, 1116.

Lieut. T. N. Bailey. Report, '83, 923.

W. R. Curtis. Report, '85, 1227.

Lieut. O. M. Carter. Report, '86, 1116; '87, 1188.

Operations.

1879-'80. Construction of jetty commenced; 1,848 cubic yards dredged from shoal, '80, 961.

1880-'81. 830 linear feet of jetty built, 34,160 cubic yards material dredged, '81, 1113.

1881-'82. 1,319 linear feet jetty built, 16,016 cubic yards dredged, '82, 1179.

1882-'83. 2,405 linear feet jetty built, 28,484 cubic yards material dredged, '83, 920, 923.

1883-'84. No operations for lack of funds, '84, 1121.

1884-'85. Strengthening and raising the upper end of jetty by the use of 6,752 square yards of mattresses and 990 cubic yards of stone, '85, 1226.

1885-'86. No operations for lack of funds, '86, 1114.

1886-'87. 40,000 cubic yards dredged from East River channel, 9,674 square yards of mattress and 1,448 cubic yards of stone placed in jetty, '87, 1186, 1189.

Projects.

By Col. Gillmore, 1880, for the formation of a channel not less than 15 feet deep at mean low water over the shoal areas below Brunswick, by dredging, and the construction of a low jetty from the northeasterly point of Buzzard's Island, about 4,300 feet long. Estimated cost, \$73,187.50, '80, 962.

In 1886 Col. Gillmore enlarged the previous project to provide for a deflecting dam across Turtle River from upper end of Buzzard's Island to the shore of Blythe Island; dredging in vicinity of the Turtle River dam; the construction of short spur-dikes in lower part of river to produce increased contraction; the raising of the jetty to an increased height, and additional dredging on the shoal in Brunswick River. Estimated cost, \$200,000, inclusive of previous appropriations of \$92,500, '86, 1113, 1116; '87, 1184.

Surveys.**MAPS.**

'80, 962; '81, 1116; '83, 922; '85, 1228; '86, 1116; '87, 1196.

BRUNSWICK, MO.—SURVEY AT.

(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)

BUCKHANNON RIVER, W. VA.—IMPROVEMENT OF.**Appropriations.**

1884..... \$1,500, '85, 1893.

1886..... 1,500, '86, 1625.

1888..... 1,500, act of August 11, 1888.

Commerce.

Justification of a limited expenditure for improvement of river, '84, 1719; '86, 1624.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 263; '85, 291; '86, 286; '87, 243.

ENGINEERS IN CHARGE.

Maj. W. E. Merrill, 1884-'85. Report, '84, 1718.

Capt. J. C. Post, 1885-'87. Reports, '85, 1892; '86, 1624.

Lieut. Col. W. E. Merrill, 1887'— Report, '87, 1832.

BUCKHANNON RIVER, W. VA.—Continued.**Engineers—Continued.****ASSISTANT.**

J. B. Holbrook. Report, '84, 1719.

Operations.

1884-'85. 7 miles of river cleared of obstructions, '85, 1893.

1885-'86. No operations, '86, 1624.

1886-'87. Channel opened to Ten-Mile Creek, '87, 1832.

Physical Characteristics.

Description of river, '84, 1718, 1720.

Plans.

In 1883 Maj. Merrill considered that a comparatively small expenditure would be justified for the improvement of the river, '84, 1719.

Projects.

The project of 1884 contemplates the formation of a rafting channel from the Three Forks to the town of Buckhannon, a distance of 24½ miles, with a width of 30 feet and a depth of 2 feet during four months of each year, '85, 291.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Maj. Merrill, '84, 1718.

BUFFALO BAYOU, TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 100.)

Appropriations.

1881.....	\$25,000, '81, 1343.
1882.....	50,000, '82, 1459.
1884.....	25,000, '84, 1306.
1-86.....	18,750, '86, 1326.
Total	118,750
1888.....	25,000, act of August 11, 1888.

Commerce.

Justification of improvement, '81, 1346; '84, 1307.

Contracts.

1881. G. L. Long, for dredging, at 21 cents per cubic yard, and removal of trees, at \$190 per mile, '82, 1459.

1882. J. J. Atkinson, for dredging, at 26 cents per cubic yard; the removal of trees and stumps, and revetment of banks, '83, 1084.

1884. E. Moore, for dredging, at 23 cents per cubic yard, and removal of snags, at \$2.70 each, '85, 1458.

1887. J. J. Atkinson, for dredging and removal of obstructions, '87, 1424.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 150; '81, 201, 204; '82, 198; '83, 203; '84, 218; '85, 227; '86, 225; '87, 190.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1880-'86. Reports, '81, 1342, 1344; '82, 1458; '83, 1083; '84, 1306; '85, 1457; '86, 1325.

Maj. O. H. Ernst, 1886-'—. Report, '87, 1423.

ASSISTANT.

B. F. Taylor. Reports, '81, 1344; '84, 1306.

Operations.

1881-'82. 24,895 cubic yards earth dredged and trees removed from 11½ miles of river bank, '82, 1459.

1882-'83. 162,680 cubic yards of earth dredged, 971 trees removed, and 1,247,801 square feet of bank cleared, '83, 1084.

1883-'84. 64,943 cubic yards dredged and 379 trees removed, '84, 1306.

1884-'85. 78,600 cubic yards dredged and 277 snags removed, '85, 1457.

1885-'86. 13,500 cubic yards dredged and 26 stumps removed, '86, 1326.

1886-'87. No operations, '87, 1423.

Physical Characteristics.

Description of bayou, '81, 1345; '87, 1423.

BUFFALO BAYOU, TEX.—Continued.**Plans.**

By Maj. Mansfield, 1880, for the formation of a channel between Simm's and White Oak Bayous, 150 feet wide and 12 feet deep. Estimated cost, \$1,125,341, '81, 1344, 1346.

Private and Corporate Work.

Charter of the Buffalo Bayou Ship-Canal Company, '87, 1425.

Projects.

By Maj. Mansfield, 1880, for the formation of a channel 100 feet wide and 12 feet deep between Simm's Bayou and mouth of White Oak Bayou, at Houston, re-vestment of bank, removal of trees and dredging. Estimated cost, \$385,299.75, '81, 1343, 1344, 1346.

The locality not considered capable of permanent improvement, '87, 190.

Surveys.

Ordered by act of June 14, 1880, '90, 150. Made under direction of Maj. Mansfield, 1880, '81, 1344.

BUFFALO HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 101.)

Appropriations.

1826-79	\$1,410,495.37
1880	90,000.00, '80, 2194.
1881	90,000.00, '81, 2423.
1882	125,000.00, '82, 2436.
1884	100,000.00, '84, 2130.
1886	112,500.00, '86, 1833.

Total 1,927,995.37

1888 225,000.00, act of August 11, 1888.

List of appropriations since 1826, '81, 2420.

Contracts.

1880. Messrs. Pratt & Co., for iron for crib construction, D. E. Bailey, for crib construction, '80, 2193, 2204. Gibson & Granger failed to enter into contract, '80, 2193.

1881. Frank Wilson, for iron work, D. E. Bailey and E. J. Kingston, for crib construction, '81, 2421, 2425.

1882. A. J. Packard, for iron work, '83, 1932, 1934.

1884. C. E. Williams, for crib construction, '84, 2127. D. E. Bailey, for repairs to breakwater, '84, 2128. I. Earnsworth, for iron, D. E. Bailey, for repair of piers, '85, 2264.

1885. D. E. Bailey, for breakwater repairs, '85, 1882.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 229; '81, 315; '82, 309; '83, 317; '84, 321; '85, 345; '86, 340; '87, 305.

BOARD OF ENGINEERS.

Convened at New York, 1886-'87, to consider the reconstruction of the superstructure of the breakwater. Report, '87, 2362, 2363.

(Cols. Casey and Abbot, Lieut. Cols. Comstock and Houston.)

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1878-'83. Reports, '80, 2192; '81, 2420; '82, 2431.

Lieut. Col. H. M. Robert, 1883. Report, '83, 1931.

Capt. E. Maguire, 1883-'86. Reports, '84, 2126; '85, 2255; '86, 1881.

Capt. C. F. Palfrey, 1886. '87, 2351.

Capt. F. A. Mahan, 1886-'— Report, '87, 2351.

Operations.

1879-'80. Breakwater extended by contract 350 linear feet; total present length 3,426 linear feet, '80, 2193.

1880-'81. Breakwater extended 694 linear feet, making total length of 4,120 linear feet, '81, 315, 2420.

1881-'82. Breakwater extended 317 linear feet, making total present length of 4,437 linear feet, '82, 2431.

1882-'83. Breakwater extended 454 linear feet, making total present length 4,891 linear feet. Repairs breakwater and light-house pier, '83, 1932, 1933.

1883-'84. Breakwater extension in progress, with repairs to breakwater, '84, 2127, 2129. Removal of wreck, '84, 2130.

BUFFALO HARBOR, N. Y.—Continued.**Operations—Continued.**

1884-'85. Breakwater extended 805 $\frac{3}{4}$ feet, making a total present length of 5,696 $\frac{1}{4}$ linear feet, '85, 2262. Repairs to breakwater and south pier, '85, 2265.

1885-'86. Breakwater extended 659 $\frac{1}{4}$ feet, making a total extension of 6,349 $\frac{3}{4}$ feet, '86, 1881. Repairs to breakwater, '86, 1882. Cost of breakwater extension, '86, 1883.

1886-'87. Repairs to structures, '87, 2354.

Physical Characteristics.

Level of lake during southwest gale of October 14, 1886, '87, 2352. Wind observations, '87, 2351.

Private and Corporate Work.

Claims of railroad company to United States pier, '80, 2195.

Agreement made with United States, '80, 2201.

Question re-opened 1884, '85, 2255.

Improper use of breakwater by parties mooring rafts thereto, '81, 2421, 2422.

Projects.

The scheme of improvement as modified at various times provides for two piers at the entrance to Buffalo Creek, for a masonry sea-wall running southwardly from the south pier, for a breakwater about one-half mile from and parallel with the shoal, and for a shore arm to the breakwater from its southerly end. Vol. I, p. 104, '87, 305, 2351, 2366.

In 1886 a masonry and concrete superstructure was adopted for the breakwater, '87, 2353, 2365.

From 1826 to 1886, inclusive, \$1,966,480.41 was appropriated. Amount estimated for completion of existing project, \$1,117,500, '87, 2357.

Surveys.**MAPS.**

'80, 2204; '81, 2424; '84, 2130; '87, 2356.

BUFFALO RIVER, MISS.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 225.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '85, 1430.

Plans.

In 1884 Capt. Turtle did not consider the river worthy of improvement, '85, 1431.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Turtle '85, 1430.

BULKHEAD ROCK, R. I. (See PROVIDENCE RIVER HARBOR, ETC.)**BURLINGTON BAY, MINN. (See AGATE BAY, MINN.)****BURLINGTON HARBOR, IOWA. (See MISSISSIPPI RIVER, FROM SAINT PAUL TO DES MOINES RAPIDS.)****BURLINGTON HARBOR, VT.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 105.)

Appropriations.

1836-'79	\$426, 172. 20
1880	10, 000. 00, '80, 558.
1881	10, 000. 00, '81, 724.
1882	12, 000. 00, '82, 709.

BURLINGTON HARBOR, VT.—Continued.**Appropriations—Continued.**

1884..... 50,000.00, '84, 2157.
 1886..... 18,750.00, '86, 1904.

Total..... 526,922.20

1888..... 35,000.00, act of August 11, 1888.

List of appropriations, '82, 709.

Contracts.

1882. Dillabeck & Murphy, for rubble-stone, at 70 cents per cubic yard, '82, 709.
 1884. L. Whitney, for breakwater extension, '85, 2307.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 89; '81, 113; '82, 114; '83, 335; '84, 328; '85, 355; '86, 349; '87, 315.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'81. Reports, '80, 557; '81, 723.

Maj. G. L. Gillespie, 1881-'82. Report, '82, 708.

Maj. W. McFarland, 1882-'83. Report, '83, 1931.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1959; '84, 2157.

Maj. M. B. Adams, 1885-'— . Reports, '85, 2307; '86, 1903; '87, 2406.

Operations.

1879-'80. Breakwater extended north 111 linear feet; repairs to breakwater, '80, 557.

1880-'81. Breakwater extended north 70 linear feet; repairs to breakwater, '81, 723.

1881-'82. Breakwater extension in progress, '82, 709.

1882-'83. Breakwater extended north 50 linear feet, '83, 1959.

1883-'84. Breakwater extended north 50 linear feet, '84, 2157.

1884-'85. Breakwater extended south 200 linear feet; 1,175 linear feet of old breakwater repaired by hired labor, '85, 2307.

1885-'86. Repairs to breakwater by hired labor, '86, 1903.

1886-'87. Slight repairs to northern end of breakwater, '87, 2409. Discussion of most economical height of stone foundations for breakwater, '87, 2407.

Projects.

Between 1836 and 1857, 1,069 linear feet of breakwater had been built. In 1867 a Board of Engineers recommended a further extension northward of 1,500 linear feet. In 1871, 831 linear feet of this extension had been made.

Between 1871 and 1874 617 linear feet were added in a southward extension, making a total extension of 2,517 linear feet, '74, 1, 274.

In 1874 an additional extension of 2,000 linear feet was adopted at an estimated cost of \$340,000, '74, 275.

In 1884, under an appropriation of \$25,000, extensive repairs were undertaken over the part of the breakwater built between 1836 and 1857, '84, 2157.

In 1886 Maj. Adams proposed a further extension of the breakwater both to the north and south with the gradual withdrawal of the work as prolonged into water 32 feet deep, '87, 315, 2406.

From 1836 to 1886, inclusive, \$526,922.20 was appropriated. In 1887 the cost of the completion of the project was estimated at \$184,250, '87, 2409.

BUSH RIVER, MD.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 150; '82, 144.

ENGINEER IN CHARGE.

Col. W. P. Craighill. Report, '82, 949.

Plans.

By Col. Craighill, for the formation of a dredged channel to Public Landing 6 feet deep at mean low water and 100 feet wide; also a basin at Public Landing 200 by 400 feet; estimated cost, \$30,000. To continue the improvement to mouth of James the cost would be \$27,000 additional, '82, 950.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Col. Craighill.

BUTTERMILK CHANNEL, NEW YORK HARBOR.—IMPROVEMENT OF.**Appropriations.**

1880.....	\$60,000, '80, 506.
1881.....	60,000, '81, 630.
1882.....	60,000, '82, 655.
1884.....	10,000, '84, 704.
1886.....	56,250, '86, 722.

Total..... 246,250

1888..... 100,000, act of August 11, 1888.

Statement of appropriations, '87, 706.

Commerce.

Importance of the improvement, '84, 602; '86, 721; '87, 707.

Contracts.

1880. H. E. Du Bois, for dredging, at 35 cents per cubic yard, '81, 631.
 1881. H. E. Du Bois, for dredging, at 22 cents per cubic yard, '82, 655.
 1882. H. E. Du Bois, for dredging, at 22 cents per cubic yard, '83, 543.
 1884. H. E. Du Bois, for dredging, at 33 cents per cubic yard, '85, 671.
 1886. United States Dredging Company, for dredging, at 23½ cents per cubic yard; contract annulled and work prosecuted by H. Du Bois' Sons, at 25 cents per cubic yard, '87, 705.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 82; '81, 99; '82, 100; '83, 96; '84, 102; '85, 92; '86, 97; '87, 60.

ENGINEERS IN CHARGE.

Col. J. Newton, 1880-'84. Reports, '80, 505; '81, 629; '82, 654; '83, 542.

Capt. J. Mercur, 1884. Report, '84, 701.

Lieut. Col. W. McFarland, 1884-'—. Reports, '85, 670; '86, 720; '87, 703.

Operations.

- 1880-'81. 80,000 cubic yards dredged, '81, 100.
 1881-'82. 137,545 cubic yards dredged, '82, 654.
 1882-'83. 232,375 cubic yards dredged, '83, 542.
 1883-'84. 207,090 cubic yards dredged, '84, 701.
 1884-'85. 30,097 cubic yards dredged, '85, 671.
 1885-'86. No operations for lack of funds, '86, 721.
 Aggregate of 466,276 cubic yards removed from 1880 to 1885, '86, 720.
 1886-'87. 89,625 cubic yards dredged, '87, 705.

Projects.

By Col. Newton, in 1880, for the removal of the shoal between Long Island and Governor's Island to a depth of 26 feet and to a width of 850 feet from the Brooklyn wharves. Estimated cost, \$210,000, '80, 506; '81, 629; '86, 721.

In 1887, after an aggregate appropriation of \$190,000, Lieut. Col. McFarland estimated that \$95,000 would be required to complete the project, '87, 705.

Surveys.**MAPS.**

'80, 506; '84, 702; '85, 670.

BUZZARD'S BAY, MASS. (See CAPE COD SHIP-CANAL.)**CABIN CREEK, MD.—EXAMINATION OF.**

(Continued from Vol. I, p. 107.)

Commerce.

Maj. Craighill considers that there is no present need for the improvement of this creek, '80, 739.

Engineers.**ENGINEER IN CHARGE.**

Maj. W. P. Craighill, 1880. Report, '80, 738.

Physical Characteristics.

Description, '80, 739.

Surveys.

1880, examination made by Maj. W. P. Craighill, '80, 738.

CACHE RIVER, ARK.—EXAMINATION OF.

(Continued from Vol. I, p. 107.)

[\$7,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 213; '87, 210.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaure, 1881. Report, '81, 1477.

Capt. H. S. Taber. Report, '87, 1547.

ASSISTANT.

Z. Harrison. Report, '80, 1478.

Commerce.

Commerce in past years quite extensive, '81, 1480.

Physical Characteristics.

Description of, '81, 1479.

Plans.

By Maj. Benyaure, 1880, for the improvement of the river from its mouth to Gray's Ferry, a distance of 160 miles, by the removal of snags, logs, and overhanging trees, at an estimated cost of \$30,316, '81, 1478.

By Capt. Taber, 1887, for the removal of snags between mouth and Riverside. Estimated cost, \$7,000, '87, 1548.

CAHABA RIVER, ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 107.)

Appropriations.

1882..... \$20,000, '83, 998.

1884..... 10,000, '84, 1189.

1886..... *7,500, '86, 202.

Commerce.

Benefits to be derived from improvement, '81, 1236, 1233.

Increase of commerce caused by improvement, '85, 1309.

Encroachments.

Bridges crossing river without draws, '87, 1287.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '83, 191; '84, 199; '85, 204; '86, 202; '87, 170.

ENGINEERS IN CHARGE.

Capt. A. N. Damrell, 1881-'85. Reports, '81, 1232; '83, 995; '84, 1186.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1295; '86, 1172; '87, 1287.

ASSISTANT.

C. B. Percy. Report, '81, 1233.

Operations.

1882-'83. 5,832 overhanging trees, stumps, logs, and snags removed, '83, 997.

1883-'84. 19,750 overhanging trees, stumps, logs, and snags removed, 220 linear feet of brush jetties built, '84, 1187.

1884-'85. Snag-boat constructed, '85, 1306.

1185-'86. 1,516 snags, logs, and trees removed, clearing the river for about 19½ miles, '86, 1174.

1886-'87. No operations, '87, 1287.

Physical Characteristics.

Description of river, '81, 1233.

Projects.

By Maj. Damrell, 1883, to obtain for the lower Cahaba River a navigable channel from its mouth to the town of Centreville, a distance of 88 miles, with a depth of 3 feet at low water and a width in open river of 100 feet, in soft rock and bar cuts, 60 feet; this to be accomplished by removal of snags, dredging through soft rock and gravel bars, and by contracting and regulating the channel. Estimated cost, \$195,000, '83, 996; '86, 202; '87, 1287.

Surveys.

From Centreville to Shade's Creek, '81, 1232.

* The act of 1886 provides that no part shall be expended until bridges crossing the river are provided with suitable draws, '87, 1287.

CAHOKIA CHUTE, MISS. RIVER. (See MISSISSIPPI RIVER OPPOSITE SAINT LOUIS.)**CALAIS, ME.** (See SAINT CROIX RIVER.)**CALCASIEU PASS, LA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 107.)

Appropriations.

1872-'79	\$15,000
1881	12,000.00, '81, 1305.
1882	3,000.00, '82, 1388.
1886	*16,255.46, '87, 185, 1379.

Total 46,255.46
 1888 (River and Pass).. 10,000.00, act of August 11, 1888.

Contracts.

1881. G. C. Fobes & Co., for dredging the proposed cut for \$10,444, '82, 1387.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 196; '82, 192; '83, 213; '84, 215; '85, 222; '86, 220; '87, 185, 188.

ENGINEERS IN CHARGE.

Maj. W. H. Howell, 1881. Report, '81, 1304.

Maj. A. Stickney, 1881-'84. Reports, '82, 1336; '83, 1129; '84, 1282.

Capt. T. Turtle, 1884-'86. Report, '85, 1414.

Maj. W. H. Heuer, 1865-'— . Reports, '85, 1414; '86, 1277; '87, 1378, 1402.

ASSISTANTS.

Lieut. O. T. Crosby. Report, '87, 1379.

T. L. Raymond. Report, '87, 1403.

Operations.

1881-'82. Formation of proposed channel, '82, 1387.

1882-'86. No operations, '83, 1129; '84, 1282; '85, 1414; '86, 1276.

1886-'87. Partial construction of pile revetment for channel over bar, '87, 1379.

Physical Characteristics.

Refilling of the previously dredged channel, '85, 1414; '86, 1277; '87, 1380.

Plans.

By Maj. Heuer, for the formation of a channel 12 feet deep by dredging and protecting jetties across the bar, at an estimated cost of \$600,000, '87, 1403.

Projects.

The project of 1871 proposed improving the bar at the head of the pass by dredging a channel 80 feet wide, $1\frac{1}{4}$ miles long, and 5 feet deep, at an estimated cost of \$15,000, '71, 558; '72, 62; '82, 1387; '86, 1277.

This work was accomplished in 1873-'74, '74, i, 73, 721.

In 1881 the previously dredged channel having closed, it was proposed to reopen it by the formation of a channel 70 feet wide and 8 feet deep at low water.

Estimated cost, \$15,000, '81, 1304; '86, 1277.

In 1886 the channel having again partially refilled, it was proposed to reform a dredged channel 100 feet wide and 6 feet deep, protected by a pile and plank revetment on each side, '87, 1379.

Surveys.

Examination of bars at mouth of river and pass ordered by act of August 5, 1886. Made under direction of Maj. Heuer, '87, 1402.

CALCASIEU RIVER, LA.—IMPROVEMENT OF.**Appropriations.**

1881	\$3,000, '81, 1301.
1882	7,000, '82, 1386.
1884	6,500, '84, 1282.

Appropriation transferred to Calcasieu Pass, '87, 1379.

* Transferred from Calcasieu River, La., by act of August 5, 1886, '87, 1379.

CALCASIEU RIVER, LA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 196, 1302; '82, 192; '83, 211; '84, 215; '85, 221; '86, 220; '87, 186, 188.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1880-'82. Report, '81, 1300, 1301.

Maj. A. Stickney, 1882-'84. Reports, '82, 1335; '83, 1127; '84, 1281.

Capt. T. Turtle, 1884-'85. '85, 1409.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1409; '86, 1276; '87, 1378, 1402.

ASSISTANTS.

A. C. Bell. Report, '81, 1302.

N. S. Davis. Report, '83, 1127.

Lieut. O. T. Crosby. Report, '87, 1379.

T. L. Raymond. Report, '87, 1403.

Operations.

1886-'87. Operations were delayed to 1886 on account of uncertainty as to whether the appropriations might be made available for both the pass and river.

Excavation of a channel 100 feet wide and 6 feet deep commenced in 1887 through bar at mouth of river; 13,408 linear feet revetment wall built, '87, 1379.

Projects.

By Maj. Howell, 1881, for improvement of river above the town of Lake Charles to Philips Bluff by cleaning channel of snags, logs, etc., to a navigable width and depth, and dredging bar at foot of Calcasieu Lake, at an estimated cost of \$25,080, '81, 196, 1302.

Surveys.

Ordered by act of June 14, 1880, '80, 146. Examination made by Maj. Howell, 1880, '81, 1301.

Examination of lower reach of river, '83, 1127. Examination of bars at mouth of river and pass ordered by act of August 5, 1886. Made under direction of Maj. Heuer, '87, 1402.

CALOOSAHATCHEE RIVER, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 108.)

Appropriations.

1882..... \$5,000, '83, 1004.
1884..... 5,000, '84, 1196.
1886..... 4,000, '86, 1153.
1888..... 10,000, act of August 11, 1888.

Contracts.

1882 S. N. Kimball, for dredging, at 62½ cents per cubic yard, '83, 1004.

1884. S. N. Kimball, for dredging, at 69½ cents per cubic yard, '85, 1274.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 193; '84, 201; '85, 197; '86, 196; '87, 157.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1883-'84. Reports, '83, 1003; '84, 1195.

Capt. W. T. Russell, 1884-'86. Report, '85, 1273.

Lieut. W. M. Black, 1886-'— . Reports, '86, 1152; '87, 1235.

Operations.

1883-'84. 6,905 cubic yards removed by dredging from bar at mouth, '84, 1195.

1884-'85. No operations for lack of funds, '85, 1274.

1885-'86. 5,000 cubic yards dredged from channel near Fish Bayou, completing project, '86, 1153.

1886-'87. Removal of snags and similar obstructions in progress, '87, 1236.

Projects.

By Capt. Damrell, 1879, for the formation of a channel 100 feet wide and 7 feet deep by dredging and removal of snags from the river's mouth to Fort Myers, a distance of 14 miles. Estimated cost, \$20,000, '79, 864, 869; '83, 1003; '85, 1273.

In 1886 \$14,000 having been appropriated and the original project completed, it was proposed to improve the river between Forts Myers and Thompson for vessels drawing 4 feet by clearing the river of obstructions and straightening and deepening the channel at Beautiful Plains. Estimated cost, \$11,000, '87, 1236.

Surveys.

1887. Surveys made, '87, 1236.

CALUMET HARBOR, ILL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 103.)

Appropriations.

1870-'79	\$277,000
1880	20,000, '80, 1989.
1881	30,000, '81, 2171.
1882	35,000, '82, 2242.
1884	20,000, '84, 1947.
1886	10,000, '86, 1704.
Total	392,000
1888	20,400, act of August 11, 1888.

Commerce.

Advantages to be derived from improvement, '80, 1989.

Contracts.

1879. Culbert Brothers, for pier construction, '80, 1987; completed, '80, 1987.
 1880. G. Hannahs, for pier extension, '81, 2172; completed, '81, 2169. O. B. Green, dredging, at 15 cents per cubic yard, '81, 2172; completed, '81, 2160.
 1881. Chicago Dredging and Dock Company, for dredging, at 26½ cents per cubic yard, '81, 2172; completed, '81, 2172.
 1883. Walsh & Hannahs, for pier extension, '83, 1748; extended, '83, 1748; completed, '84, 1946. Calumet and Chicago Canal and Dock Company, for dredging, at 23 cents per cubic yard, '83, 1748; extended, '83, 1748; completed, '84, 1946.
 1886. H. B. Herr & Co., for pier extension, '87, 2118.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 211; '81, 286; '82, 280; '83, 288, 1748; '84, 290; '85, 313; '86, 307; '87, 273.

BOARD OF ENGINEERS.

Convened by S. O. No. 84, Corps of Engineers, 1882, Lieut. Col. Houston, Majs. Smith and Benyaurd, '83, 1748. (See PROJECTS.)

ENGINEERS IN CHARGE.

Maj. G. J. Lydecker, 1877-'82. Reports, '80, 1986; '81, 2168.

Maj. W. H. H. Benyaurd, 1882-'86. Reports, '82, 2240; '83, 1745; '84, 1946; '85, 2051; '86, 1704.

Maj. T. H. Handbury, 1886-'—. Report, '87, 2117.

ASSISTANT.

G. A. M. Liljencrantz. Report, '82, 2243.

Legislation.

Act recommended by Board of Engineers, 1882, for protection of channel in Calumet River, '83, 1750.

Operations.

1879-'80. 200 linear feet pier extension, repairs to piers, and dredging through bar at entrance to harbor, '80, 1987.

1880-'81. 250 linear feet crib-pier built and 14,547 cubic yards of dredging; minor repairs to piers, '81, 2169.

1882-'83. 11,007 cubic yards of material dredged, 200 feet of crib-work completed, and piles driven for pier foundation, '83, 1745.

1883-'84. Pier extension and dredging; 247 cords of stone purchased for refilling pier, '84, 1946.

1884-'85. South pier extended 200 linear feet; repair of 748 feet of plank revetment, '85, 2051.

1885-'86. No operations from lack of funds, '86, 307.

1886-'87. South pier extended 150 feet. Total work done since 1870: North pier extended 3,400 feet; south pier, 1,870 feet; 384,376 cubic yards dredged, '87, 2117.

Projects.

By Maj. Wheeler, in 1870, for the formation of a harbor by the extension of two parallel piers 300 feet apart and extended to at least the 12-foot curve. Estimated cost, \$300,000, '70, 104, 107; '71, 117; '76, ii, 441, 442. Modified subsequently to provide a channel of entrance 16 feet deep and 300 feet wide, '80, 211, 1988; '86, 306.

By Board of Engineers, 1882, for the formation of a dredged channel in Calumet River, 200 feet wide and 16 feet deep, from Lake Michigan to the fork at Calumet Lake. Estimated cost, \$225,000, '83, 1750.

(Lieut. Col. Houston, Majs. Smith and Benyaurd.)

CALUMET HARBOR, ILL.—Continued.**Projects—Continued.**

Approved by the Chief of Engineers, '83, 1748.

In 1886, \$392,000 having been appropriated, \$11,400 is estimated for completion of existing project, '86, 307.

Surveys.

Local survey made, '80, 1987.

1882. Survey of bar at mouth of Calumet River, '82, 2240.

MAPS.

'80, 1988; '83, 1746; '84, 1946; '85, 2051.

CALUMET RIVER, ILL. AND IND.—IMPROVEMENT OF.**Appropriations.**

1854..... \$50,000, '84, 1948.

1886..... 30,000, '86, 1703.

1888..... 50,000, act of August 11, 1888.

Commerce.

Vast commerce interested in and to be affected by improvement, '82, 2248.

Description of manufacturing enterprises interested, '82, 2255; '85, 2062.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 287; '82, 282; '84, 290, 291; '85, 314, 315; '86, 308; '87, 275, 277.

BOARD OF ENGINEERS.

Convened at Chicago October 6, 1882, by S. O. No. 64, C. E., to report upon proposed improvement of Calumet River, '83, 1748.

(Lieut. Col. Houston and Maj. Smith and Benyaud.)

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaud, 1881-'86. Reports, '82, 2247; '83, 1745; '84, 1947, 1951; '85, 2055, 2057, 2059; '86, 1707; '87, 2172.

Maj. T. Handbury, 1886.—. Report, '87, 2167.

ASSISTANT.

G. A. M. Liljenorantz. Reports, '82, 2251; '85, 2061.

Operations.

No operations on account of right of way not having been conveyed to the United States free of expense, and the United States not having been released from all liability for damages to adjacent property owners, '86, 308; '87, 276.

Plans.

In 1882 Maj. Lydecker did not consider Little Calumet River worthy of improvement, '84, 1952.

In 1884 Maj. Benyaud did not consider the proposed ship canal between Calumet River and Calumet Lake a public necessity, '85, 2070.

In 1886 Maj. Benyaud did not consider as worthy of improvement that part of the river from the Forks to Blue Island, '87, 2173.

Projects.

By Board of Engineers, 1882, for improvement of the lower section of Calumet River from Lake Michigan to the Forks, a distance of 6½ miles, by dredging channel 200 feet wide and 16 feet deep. Estimated cost, \$225,000, '83, 1748, 1749, 1750; '86, 308.

In 1885 Maj. Benyaud proposed the extension of the improved channel from the Forks to a point half a mile east of Hammond, at an additional cost of \$200,000, '85, 2061, making the entire estimated cost of the project \$425,000, '87, 2167, 2170.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Maj. Lydecker, '82, 2247; '84, 1951.

Examination of Little Calumet River ordered by act of August 2, 1882. Made, 1882, under direction of Maj. Lydecker, and reported as not a public necessity, '84, 1952.

Examination for a ship-canal from Calumet River to Lake Calumet ordered by act of July 5, 1884. Made, 1884, under direction of Maj. Benyaud, and reported as not a public necessity, '85, 2057.

* Provision to act states that no part of the appropriation shall be expended until right of way is conveyed to the United States free of cost.

CALUMET RIVER, ILL. AND IND.—Continued.**Surveys—Continued.**

Examinations from Lake Calumet to Blue Island ordered by act of August 5, 1886.

Made under direction of Maj. Benyaurd, '87, 2172.

Examination from the Forks to Hammond ordered by act of July 5, 1884. Made under direction of Maj. Benyaurd, '85, 2059.

MAPS.

'82, 2251.

CALUMET RIVER, ILL.—EXAMINATION FOR PROPOSED SHIP-CANAL.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 315.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaurd. Report, '85, 2057.

Plans.

Maj. Benyaurd, in 1884, did not then consider a canal from Calumet River to Lake Calumet called for by the commercial requirements of the locality, '85, 2058.

Private and Corporate Work.

Improvement made by town of Hyde Park, '85, 2058.

Surveys.

Ordered by act of July 5, 1884, '85, 314. Made under the direction of Maj. Benyaurd, 1884, '85, 2057.

CAMBRIDGE HARBOR, MD.—IMPROVEMENT OF.

(See CHOPTANK CREEK, MD.)

(Continued from Vol. I, p. 111.)

Appropriations.

1871-'79 \$32,500

1888 5,000, act of August 11, 1888.

Contracts.

American Dredging Company, for dredging, '84, 902; completed, '85, 888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 103; '81, 137; '82, 132; '83, 137; '84, 144; '85, 135; '87, 97.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1880-'85. Reports, '80, 637; '81, 879; '82, 853; '83, 678; '84, 902.

W. F. Smith, U. S. Agent, 1885-'— . Reports, '85, 888; '87, 851, 853.

ASSISTANT.

C. Humphreys. Report, '87, 852.

Operations.

1883-'84. Enlargement of harbor by dredging to extent of available funds, '84, 902; '85, 888.

Physical Characteristics.

Description of, '84, 144.

Plans.

By W. F. Smith, 1887, for the formation of a dredged channel 150 feet wide and 12 feet deep to the railroad wharf, 10 feet to the draw-bridge, and 8 feet to the head of the wharfage. Estimated cost, \$17,136, '87, 853.

Projects.

By Maj. Craighill, 1871, for the formation by dredging of a channel of entrance to Choptank Creek and a basin 8 feet deep abreast of Cambridge, '74, ii, 24. Modified in 1874 for enlargement of basin and channel leading thereto, '79, 501. Amount appropriated from 1871 to 1879, inclusive, \$32,500, '87, 852.

Surveys.

1880. Resurvey of harbor and approaches, '80, 638.

Ordered by act of August 5, 1886. Made under direction of W. F. Smith, '87, 851, 853.

CAMDEN HARBOR, ME.—EXAMINATION OF.

[\$5,000 appropriated by act of August 11, 1888.]

Surveys.

Examination ordered by act of August 5, 1886, '87, 22.

CAMDEN, N. J. (See DELAWARE RIVER AT PHILADELPHIA, PA.)

CANAL BETWEEN BAKER'S AND SHOALWATER BAYS, WASH. (See BAKER'S AND SHOALWATER BAYS, WASH., CANAL BETWEEN.)

CANAL (SHIP) ACROSS BERGEN NECK, N. J. (See BERGEN NECK, N. J., SHIP-CANAL ACROSS.)

CANAL FROM CALUMET RIVER TO CALUMET LAKE. (See CALUMET RIVER EXAMINATION FOR PROPOSED SHIP-CANAL.)

CANAL AT THE CASCADES, COLUMBIA RIVER, OREGON. (See COLUMBIA RIVER AT THE CASCADES.)

CANAL (SHIP) ACROSS CHARLESTON NECK, S. C. (See CHARLESTON NECK, S. C., SHIP-CANAL ACROSS.)

CANAL CONNECTING CHESAPEAKE AND DELAWARE BAYS. (See CHESAPEAKE AND DELAWARE BAYS, SURVEY OF SHIP-CANAL TO CONNECT.)

CANAL AT DALLES OF THE COLUMBIA RIVER, OREGON. (See COLUMBIA RIVER AT THE DALLES.)

CANAL AT DES MOINES RAPIDS, MISSISSIPPI RIVER. (See DES MOINES RAPIDS CANAL.)

CANAL ON FOX RIVER, WIS. (See FOX AND WISCONSIN RIVERS.)

CANAL TO CONNECT GALVESTON WITH BRAZOS RIVER, TEX. (See GALVESTON AND BRAZOS RIVER, TEX., CANAL TO CONNECT.)

CANAL, HENNEPIN. (See HENNEPIN CANAL.)

CANAL CONNECTING THE HEADWATERS OF THE HIAWASSEE, TENNESSEE, AND SAVANNAH RIVERS—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 190; '81, 258.

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '81, 1888.

ASSISTANT.

S. Whinery. Report, '81, 1890.

Plans.

Maj. King considers that a survey costing \$15,000 would be required, upon which to submit plans and estimates, '81, 1889.

Surveys.

Ordered by ac of June 14, 1880, '80, 190.

Report made by M. j. King, 1881, '81, 1888.

CANAL, ILLINOIS AND MICHIGAN. (See ILLINOIS AND MICHIGAN CANAL, ENLARGEMENT OF.)

CANAL (SHIP) FROM LAKE ERIE TO THE WABASH AND OHIO RIVERS—SURVEY OF.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 229; '81, 315.

ENGINEER IN CHARGE.

Maj. J. M. Wilson. Report, '81, 2348.

ASSISTANTS.

B. Holley. Report, '81, 2363.

C. D. Ward. Report, '81, 2400.

W. S. Williams. Report, '81, 2393.

Plans.

By Maj. Wilson, 1880, for the enlargement of the prism of existing canal from Toledo to La Fayette, 216 miles, to a width of 70 feet; and locks 110 feet long, 18 feet wide, and 7 feet over mitre sill. Estimated cost, \$24,236,135, '81, 2352, 2354, 2362, 2393.

For the enlargement of existing canal from Junction City to Cincinnati, to a width of 70 feet, locks 110 feet long, 18 feet wide, and 7 feet over mitre sill. Estimated cost, \$23,440,275, '81, 2356, 2358, 2363, 2400.

Private and Corporate Work.

Description of Wabash and Erie Canal, '81, 2349, 2413.

Of the Miami and Erie Canal, '81, 2354, 2414.

Surveys.

Ordered by act of June 14, 1880, '80, 229.

Made under direction of Maj. Wilson, 1880, '81, 2348.

MAPS.

Of proposed routes, '81, 2362.

CANAL AT LOUISVILLE, OHIO RIVER. (See LOUISVILLE AND PORTLAND CANAL.)

CANAL AT MUSCLE SHOALS, TENN. (See TENNESSEE RIVER.)

CANAL AT SAINT CLAIR FLATS, MICH. (See SAINT CLAIR FLATS CANAL.)

CANAL FROM SAINT JOHN'S RIVER TO JUPITER INLET, FLA. (See SAINT JOHN'S RIVER TO JUPITER INLET, EXAMINATION FOR CANAL BETWEEN.)

CANAL AT SAINT MARY'S FALLS, MICH. (See SAINT MARY'S FALLS CANAL AND RIVER.)

CANAL FROM SAINT MARY'S RIVER TO GULF OF MEXICO, FLA.—SURVEY OF.

Commerce.

Commercial importance of canal, '80, 976.

Probable resources of canal, '80, 981.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 132.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore. Report, '80, 973.

ASSISTANT.

S. L. Tremont. Report, '80, 994.

Physical Characteristics.

Elevations above sea level, '80, 975.

Results of borings, '80, 976.

Plan.

By Lieut. Col. Gillmore, 1880, for a ship canal (location shown on map, '80, 1006) 80 feet wide at bottom and 180 feet at water line, 25 feet deep, with double locks 500 feet long and 65 feet wide, '80, 986. Estimated cost, \$50,278,746, '80, 994, 1009.

Surveys.

Ordered by act of June 18, 1878, '80, 132. Made under direction of Col. Gillmore, 1878; '80, 973.

MAPS.

'80, 1006.

CANAL AROUND SMITH'S SHOALS, CUMBERLAND RIVER.
(See CUMBERLAND RIVER CANAL AT SMITH'S SHOALS.)

CANAL AT STURGEON BAY, WIS. (See STURGEON BAY CANAL.)

CANARSIE BAY, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 112.)

Appropriations.

1880	\$10,000, '80, 515.
1881	5,000, '81, 650.
1882	3,000, '82, 670.
1884	5,000, '84, 732.
1886	10,000, '86, 748.

Total	33,000
1888	10,000, act of August 11, 1888.

Commerce.

Increased business through restoration of channel, '81, 651.

Benefit of improvement, '83, 565.

CANARSIE BAY, N. Y.—Continued.**Contracts.**

1880. Henry Du Bois & Sons, for construction of pile dike, '81, 650; completed, '81, 651.
 1881. E. Brainard, for dredging, at 50 and 40 cents per cubic yard, '83, 565; completed, '83, 564.
 1884. Henry Du Bois & Sons, for dredging and diking, at 30 cents per cubic yard, and \$29.37 per linear foot respectively, '85, 740; completed, '85, 739.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 84; '81, 104; '82, 105; '83, 103; '84, 108; '85, 98; '86, 101; '87, 64.

ENGINEERS IN CHARGE.

Col. J. Newton, 1878-'83. Reports, '80, 514; '81, 649; '82, 669.
 Lieut. Col. G. L. Gillespie, 1883-'86. Reports, '83, 564; '84, 731; '85, 739.
 Lieut. Col. W. McFarland, 1886-'— . Reports, '86, 746; '87, 737.

Operations.

- 1880-'81. 1,000 linear feet of timber dike built, '81, 649.
 1881-'82. No operations, '82, 670.
 1882-'83. 9,726 cubic yards material dredged, '83, 564.
 1883-'84. No operations, '84, 731.
 1884-'85. 7,535 cubic yards material dredged and 50 feet added to east end of dike, '85, 739.
 1885-'87. No operations, '86, 747; '87, 740.

Projects.

By Col. Newton, 1879, to afford a channel of entrance into Canarsie Bay, of navigable width, and of not less than 6 feet depth through the aid of dikes, inclosing a tidal basin. Estimated cost, \$38,000, '79, 400; '80, 84; '82, 670.

Surveys.

Canarsie Bay.

MAPS.

'82, 670.

CANE RIVER, LA.—IMPROVEMENT OF.

(See also BAYOU PIERRE.)

Appropriations.

1884..... \$2,500, '85, 1496.

Commerce.

Statistics, '84, 1367.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 227; '85, 233; '86, 230; '87, 194.

ENGINEERS IN CHARGE.

Capt. A. M. Miller, 1882-'85. Report, '84, 1366.
 Capt. E. Bergland, 1885-'86. Reports, '85, 1495; '86, 1349.
 Capt. J. H. Willard, 1886-'— . Report, '87, 1452.

ASSISTANT.

P. C. Montgomery. Report, '84, 1367.

Operations.

1884-'85. 2,504 shore and channel snags removed, 4,517 trees and stumps out, and 1,250 cubic yards rock blasted, '85, 1495.
 1885-'86. No operations, '86, 1349; '87, 1452.

Physical Characteristics.

River described, '84, 1367.

Projects.

By Capt. Miller, 1882, for removal of obstructions from head to mouth of the river, so as to allow a navigation of 6 months in the year. Estimated cost, \$7,665, '84, 1368; '87, 1452.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1883, under direction of Capt. Miller, '84, 1366.

CANEY FORK RIVER, TENN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 112.)

Appropriations.

1880.....	\$6,000, '80, 1689.
1881.....	4,000, '81, 1870.
1882.....	4,000, '82, 1855.
1884.....	3,000, '84, 1654.
1886.....	3,000, '86, 1524.

Total 20,000

1888..... 2,500, act of August 11, 1888.

Commerce.

Merchandise transported on river, '84, 1654.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 188; '81, 254; '82, 248; '83, 256; '84, 256; '85, 278; '86, 269; '87, 235, 236.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1878-'86. Reports, '79, 1275; '80, 1688; '81, 1869; '82, 1854; '83, 1499; '84, 1653; '85, 1768, 1774.

Lieut. Col. J. W. Barlow, 1886'— Reports, '86, 1523; '87, 1768, 1768.

ASSISTANT.

C. A. Locke. Report, '87, 1769.

Operations.

1880-'81. 91 cubic yards rock, 2,368 cubic yards of gravel, and 3,956 logs, snags, etc., removed from channel; 555 cubic yards stone placed in dams, and 260 linear feet of wing-dam built, '81, 1870.

1881-'82. 2,598 cubic yards log and stone dams built, 200 cubic yards gravel and loose rock excavated, and 2,196 trees and snags removed, '82, 1854.

1882-'83. 365 trees, snags, and stumps cut down and removed, 775 cubic yards of gravel put in dams, and 250 cubic yards stone quarried for dam, '83, 1500.

1883-'84. 347 cubic yards of stone quarried, 1,735 cubic yards of riprap dam built, and 2,595 cubic yards rock and gravel excavated from channel; 928 trees, stumps, and snags removed, '84, 1653.

1884-'85. 600 cubic yards of rock quarried and placed in riprap dams, 310 linear feet riprap dam built, 2,595 cubic yards gravel and loose rock excavated, and 1,609 trees, stumps, and snags removed, '85, 1769.

1885-'86. No work done, through exhaustion of available funds, '86, 269.

1886-'87. No operations, '87, 1767.

Projects.

By Capt. Overman, 1878, for the formation of a navigable channel during five months of the year from the mouth to Slingo by removal of obstructions, dredging, and rock removal, and construction of riprap dams. Estimated cost \$30,223, '79, 1275, 1277; '83, 1500; '87, 1767.

By Lieut. Col. Barlow, 1886, for extending navigation from Slingo to Frank's Ferry. Estimated cost, \$15,000; making entire estimated cost \$45,000, '87, 1767, 1769.

Surveys.

Examination with view to extension of Caney Fork River survey to Frank's Ferry.

Made, 1884, under direction of Maj. King, '85, 1774.

Examination ordered by act of August 5, 1886. Made under direction of Lieut. Col. Barlow, '87, 1768.

CANNON RIVER, MINN.—SURVEY FOR RESERVOIRS ON.

(See also MISSISSIPPI RIVER RESERVOIRS AT HEADWATERS OF.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 247; '82, 242; '84, 250.

ENGINEER IN CHARGE.

Maj. C. J. Allen. Report, '82, 1833.

ASSISTANTS.

J. P. Frizell. Reports, '82, 1835; '84, 1634.

R. Davenport. Report, '84, 1635.

Physical Characteristics.

Drainage area and reservoir capacity, '82, 1834; '84, 1635.

Surveys.

Ordered by act of March 3, 1881. Made under direction of Maj. Allen, '82, 1833.

CANOOCHEE RIVER, GA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '80, 132; '81, 179.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore. Report, '81, 1157.

Physical Characteristics.

Described, '81, 1157.

Plans.

By Lieut. Col. Gillmore, 1880, for improvement of river by clearing of snags and leaning trees, partial removal of rock bars, and formation of out-offs. Estimated cost, \$46,094.41. If improvement is confined to lower 38 miles of river, the estimated cost is \$9,405, '81, 1158.

Surveys.

Ordered by act of June 14, 1880, '80, 132. Examination made under direction of Lieut. Col. Gillmore, '81, 1157.

CAPE FEAR RIVER, N. C.—EXAMINATION OF NORTHEAST BRANCH OF.**Commerce.**

Statistics, '85, 1129, 1131.

Obstructing bridges, '85, 1128, 1130, 1131.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 177.

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '85, 1128, 1130.

ASSISTANT.

C. Humphreys. Report, '85, 1131.

Obstructions.

From bridges without draws, '85, 1129, 1130.

Plans.

By Capt. Bixby, 1885, for the removal of old bridge piers, at an estimated cost of \$700, '85, 1130, 1131.

Surveys.

Examination ordered by act of July 5, 1884. Made under the direction of Capt. Bixby, '85, 1128, 1130.

CAPE FEAR RIVER, N. C., above Fayetteville.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 177.

ENGINEERS IN CHARGE.

Maj. W. P. Craighill. Report, '72, 741, 749.

Capt. J. Mercur. Report, '84, 1064.

Physical Characteristics.

Description of river, '72, 742.

Plans.

Since the only practicable improvement would involve a large expenditure, the river was not considered worthy of improvement or the work a public necessity, '72, 742; '84, 1065.

Surveys.

Ordered by act of March 3, 1871. Made under the direction of Maj. Craighill, '72, 742. Examination ordered by act of August 2, 1882. Made under the direction of Capt. Mercur, '84, 1064.

CAPE FEAR RIVER, N. C.—IMPROVEMENT OF, BETWEEN WILMINGTON AND FAYETTEVILLE.

(Continued from Vol. I, p. 114.)

Appropriations.

1881.....	\$30,000, '81, 1081.
1882.....	30,000, '82, 1099.
1884.....	5,000, '84, 1043.
1886.....	11,250, '86, 998.

Total.....	76,250
1888.....	12,000, act of August 11, 1888.
Aggregate of appropriations, '87, 1045.	

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 168; '82, 160; '83, 167; '84, 172; '85, 170; '86, 166; '87, 131.

ENGINEERS IN CHARGE.

Maj. W. P. Craighill, 1870-'80. Report, '80, 695.

Capt. C. B. Phillips, 1880-'81. '81, 985.

Capt. J. Mercur, 1881-'85. Reports, '81, 1017, 1018; '82, 1098; '83, 858; '84, 1042.

Capt. W. H. Bixby, 1885-'— Reports, '85, 1083; '86, 995; '87, 1044.

ASSISTANTS.

W. H. James. Reports, '82, 1099; '83, 859; '84, 1043.

C. Humphreys. Reports, '85, 1084; '86, 999.

Legislation.

\$10,000 paid to Cape Fear Navigation Company for deed extinguishing right to collect tolls for navigation on river between Wilmington and Fayetteville, '81, 1017.

Operations.

1881-'82. 811 trees, logs, snags, and stumps removed, clearing 23 miles of river, '82, 1100.

1882-'83. 14,287 trees, stumps, logs, and snags removed, '83, 859.

1883-'84. 6,712 trees, stumps, logs, and snags removed, '84, 1043.

1884-'85. 1,442 linear feet timber jetty and 300 linear feet of rock jetty built; 301 linear feet old log jetties sheeted; 8,644 trees, stumps, and snags removed, '85, 1085.

1885-'86. 874 trees, logs, and snags removed; 680 cubic yards hard mud and 1,438 cubic yards rock and hard pan dredged, '86, 999.

1886-'87. Small amount of work done by hired labor, '87, 1046.

Projects.

By Capt. Phillips, 1881, for clearing snags, trees, etc., from 75 miles of river; for dredging a channel at Thames Shoal 1,900 feet long, 60 feet wide, and 5 feet deep at low water; and for construction of 5,000 linear feet of experimental dike. Estimated cost, \$55,775, '81, 1018. Modified, 1885, by Capt. Bixby, to secure a 4-foot channel from Wilmington to Elizabethtown, thence a similar 3-foot channel to Fayetteville, at an increased cost of \$200,000, '85, 1084. Modified, 1886, by Capt. Bixby, for removal of snags, logs, and stumps, and construction of 84,000 linear feet rock jetty, at a cost of \$480,000, inclusive of \$65,000 previously appropriated, '86, 996; '87, 1045.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Capt. Phillips, '80, 1018.

Surveys made of 16 shoals, '85, 1083.

MAPS.

'85, 1066.

CAPE FEAR RIVER, N. C., below Wilmington.—IMPROVEMENT AT ENTRANCE TO.

(Continued from Vol. I, p. 114.)

Appropriations.

1829-'79.....	\$1,430,728.92
1880.....	70,000.00, '80, 697.
1881.....	140,000.00, '81, 919.
1882.....	225,000.00, '82, 934.

CAPE FEAR RIVER, N. C.—Continued.

Appropriations—Continued.

1884.....	\$200,000.00, '84, 938.
1886.....	157,600.00, '86, 1004.

Total..... 2,223,228.92

1888..... 245,000.00, act of August 11, 1888.

List of appropriations, '86, 1007.

Commerce.

Statistics relating to ocean commerce, '80, 712; '84, 947; '86, 1059.

Advantages resulting from improvement, '82, 946.

Contracts.

1879. Ross & Pennypacker, for furnishing stone, at \$2.24 and \$2.29 per ton, '80, 697; completed, '80, 699.

1881. G. H. Ferris, for dredging, at 14½ cents per cubic yard, '81, 921; completed, '83, 719.

1883. National Dredging Company, for dredging, at 16½ cents per cubic yard; annulled, '83, 719. New York Steam Dredging Company, for dredging, at 17½ cents per cubic yard, '83, 718; completed, '83, 720. New York Steam Dredging Company, for dredging, at 14½ cents per cubic yard, '84, 938. Ross & Lara, for brush and cane, at \$1.60 and \$2.60 per cord, respectively, '84, 938; completed, '84, 942. J. C. Springer, for ratline and spun yarn, at 10½ and 9½ cents per pound, respectively, '84, 938; completed, '84, 942. G. M. Summerell, for scows, at \$1.150, \$600, \$580, \$566, and \$550, respectively, '84, 938; completed, '84, 941. Ross & Lara, for stone, at \$1.35 per ton, '84, 939; completed, '85, 1087.

1884. Ross & Lara, for stone, at \$1.48 per ton, '86, 1012; completed, '85, 1088. G. J. French, for stone, at \$1.55 and \$1.48 per ton; extended, '85, 1088; completed, '86, 1012. J. C. Froehlich & Co., for steam-boiler, at \$1,240; completed, '85, 1088. R. Moore, for dredging, at 14½ cents per cubic yard, '85, 1089; extended, '85, 1089; completed, '85, 1093.

1886. A. Martin, for jetty stone, at \$1.52 per ton, '87, 1052.

1887. Atlas Dredging Company, for dredging, at 9 cents per cubic yard, '87, 1052.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125, 109; '81, 148; '82, 143, 941; '83, 147; '84, 150; '85, 171; '86, 168; '87, 132.

BOARD OF ENGINEERS.

Constituted by Special Order No. 129, Corps of Engineers, 1881, '82, 942. (See PROJECTS.)

(Lieut. Col. Gillmore, Craighill, and Comstock, and Capt. Turtle.)

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1878-'85. Reports, '80, 695; '81, 918, 919, 920; '82, 934; '83, 717; '84, 937.

Capt. W. H. Bixby, 1885—. Reports, '85, 1087; '86, 1000; '87, 1047.

ASSISTANT.

H. Bacon. Reports, '80, 698; '81, 922; '82, 937; '83, 718; '84, 939; '85, 1091; '86, 1011; '87, 1053.

Operations.

1879-'80. 28,398 cubic yards of riprap placed in dam and 70,245 cubic yards sand removed by suction-dredge from Baldhead Channel, '80, 696; two lighters and scow constructed, '80, 698; repairs to pumping apparatus, '80, 701.

1880-'81. 5,427 tons contract stone for coping, 2,367 tons rough, heavy stone, and 12,880 cubic yards riprap delivered in dam, '81, 923; 218 tons stone ballast placed in dam, '81, 922; 62,044 cubic yards dredged in Baldhead Channel; 81,924 small trees transplanted at Federal Point, Zeke's and Smith's islands, '81, 926.

1881-'82. 303,535 cubic yards of material dredged from Snow's Marsh Channel, '82, 937; 21,967 cubic yards material dredged from Baldhead Channel, '82, 939; flanks of dam strengthened with 238 cubic yards stone riprap, '82, 938. Unsuccessful attempt to close northerly swash by pile-work, '82, 938.

1882-'83. 986,661 cubic yards material dredged from Snow's Marsh Channel, '83, 719; repair of steam-tug, '83, 721.

1883-'84. 333,129 cubic yards material dredged from Snow's Marsh Channel and Mid-night Shoal, '84, 940; 4,635 cords brush, 191 cords cane, and 11,861 tons stone delivered on dam, '84, 941; 1,338 tons stone ballast purchased and 417 cords brush, '84, 194; wharf built, '84, 194; 53,350 square yards mattress laid, at an average cost of 66½ cents per square yard, '84, 942; repairs to suction dredge Woodbury, '84, 943.

CAPE FEAR RIVER, N. C.—Continued.**Operations—Continued.**

1884-'85. 39,235 tons stone delivered, '85, 1091; two scows built by hired labor, '85, 1088; 321,925 cubic yards material dredged, '85, 1089.

1885-'86. 325,449 cubic yards material dredged, '86, 1012; removal of stumps by dynamite, '86, 1012. History of operations from 1761 to 1886, '86, 1004. History of past operations, '86, 943, 1006, 1008.

1886-'87. 332,112 cubic yards dredged from the shoals; 11,630 tons stone placed in dike; 10,125 cubic yards dredged from bar; surveys of river shoals, '87, 1049, 1053.

Physical Characteristics.

Tidal observations, '80, 699; '81, 925, 927; '82, 940; '83, 723; '84, 945; '85, 1096.

Table of prevailing direction of wind at Smithville and Federal Point, '80, 703.

Table showing greatest differences of the water-level between the river and sea-sides of the dam at the new inlet during flood and ebb tides, '80, 710.

Advance of shore-lines of Federal Point and Zeke's Island; extension of beach, '83, 720; '84, 940.

Condition of shore-line, 1886, '86, 1014. Geographical description of river, '86, 1000. Changes, 1852 to 1885, '85, 1090.

Private and Corporate Work.

Appropriations made by State of North Carolina, 1822 to 1829, '86, 1007.

Works carried on under the State, '82, 943; '86, 1008.

Projects.

History of past projects and operations, '82, 943; '86, 168, 1006; '87, 1047.

The Board of Engineers, 1881, in preliminary report, recommend that existing works between Zeke's and Smith's islands be strengthened, and that upon a threatened break in the low beach south of Smith's Island a mattress and riprap sill be placed to prevent such break, '82, 947.

(Lieut. Cola. Gillmore, Craighill, and Comstock, and Capt. Turtle.)

The projects of 1872 to 1882 proposed the extension of New Inlet Dam 2 miles down stream to prevent further erosion of Smith's Island. The project of 1875 proposed occasional dredging in the outer bar; and the projects of 1874 to 1881, for the improvement of the 20 miles above New Inlet, proposed dredging wherever necessary to secure a channel eventually 16 feet deep at mean low water and 270 feet wide. Amounts appropriated from 1829 to 1886, \$2,223,223.92. Amount estimated to complete project in 1886, \$245,000, '82, 947; '86, 168, 1006. Increased in 1887 to \$265,000, '87, 1048, 1051, 1058.

Surveys.

1882. From head of Snow's Marsh to Wilmington, '82, 937.

1882. From Price's Creek to Wilmington, '82, 932; '83, 721.

1884. Baldhead Channel, '84, 943.

1885. Baldhead Channel, '85, 1095.

1885. Of beaches in vicinity, '85, 1096.

1886. From entrance to Reeve's Point, '86, 1013. Effect of storms, '82, 944.

MAPS.

'81, 922; '83, 722; '84, 940; '85, 1090, 1094; '86, 1002, 1016; '87, 1050.

CAPE FEAR AND WACCAMAW RIVERS, N. C.—SURVEY FOR WATER CONNECTION BETWEEN.

[\$15,000 appropriated by act of August 11, 1888.]

Engineers.

CHIEF OF ENGINEERS.

Report, '81, 168.

ENGINEER IN CHARGE.

Capt. J. Mercur. Report, '82, 1119.

ASSISTANT.

J. P. Darling. Report, '82, 1120.

Physical Characteristics.

Route described, '82, 1121.

Plans.

Capt. Mercur considered that the cost of the desired improvement, from \$1,500,000 to \$3,250,000, was so great as to be virtually prohibitive, '82, 1120.

Surveys.

Ordered by act of March 3, 1881. Made under the direction of Capt. Mercur, '82, 1119.

CAPE GIBARDEAU, IMPROVEMENT of Mississippi River at.
(See MISSISSIPPI RIVER, BETWEEN MOUTHS OF ILLINOIS AND OHIO RIVERS.)

CAPE GREGORY, OREGON. (See HARBOR OF REFUGE ON PACIFIC COAST.)

CAPE MAY TO ATLANTIC CITY, N. J.—(Examination of thoroughfare between, ordered by act of August 5, 1886, '87, 86.)

CARP RIVER, MICH.—EXAMINATION OF, WITH VIEW TO AFFORDING AN ENTRANCE TO CARP LAKE FOR A HARBOR OF REFUGE.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 2208.

ENGINEER IN CHARGE.

Capt. D. W. Lockwood, 1887. Report, '87, 2208.

Plans.

Capt. Lockwood, 1887, reports the locality as unworthy of improvement in view of its impracticability, '87, 2209.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Lockwood, '87, 2208.

CASEVILLE, MICH.—EXAMINATION FOR HARBOR AT.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 301; '84, 308.

ENGINEER IN CHARGE.

Maj. F. U. Farquhar. Report, '84, 2077.

ASSISTANT.

C. P. Gilbert. Report, '84, 2077.

Plans.

Maj. Farquhar considered that the locality was not worthy of improvement or the work a public necessity, '84, 2077.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Farquhar, '84, 2077.

CASHIE RIVER, N. C.—SURVEY OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 164.

ENGINEER IN CHARGE.

Capt. F. A. Hinman. Report, '85, 1053, 1054.

ASSISTANT.

H. C. Collins. Report, '85, 1053, 1055.

Physical Characteristics.

Description of river, '85, 1056.

Plans.

By Capt. Hinman, 1885, for the removal of snags, wrecks, and similar obstructions, from the mouth to Windsor, a distance of 25 miles. Estimated cost, \$30,000, '85, 1055, 1058.

Surveys.

Examination ordered by act of July 5, 1884. Made under the direction of Capt. Hinman, '85, 1053, 1054.

CASSIDY'S BAYOU, MISS.—EXAMINATION OF.**Commerce.**

Small amount of, to be benefited, '85, 1534, 1537.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 243; '87, 203

ENGINEERS IN CHARGE.

Capt. E. Bergland. Report, '85, 1534.

Capt. J. H. Willard. Report, '87, 1497.

ASSISTANT.

F. S. Burrows. Report, '85, 1535.

Physical Characteristics.

Bayou described, '85, 1535.

Plans.

Capt. Bergland considered that the removal of snags and similar obstructions from the 44 miles of bayou between the mouth and Hopson's Bayou would cost \$8,000, but that the bayou was not worthy of improvement, '85, 1534, 1537.

In 1887 Capt. Willard recommended the expenditure of \$5,000 to clear the bayou from snags to a point 50 miles above the mouth, '87, 1497.

Surveys.

Examination ordered by acts of July 5, 1884, and August 5, 1886. Made under the direction of Capt. Bergland, 1885, '85, 1534, and Capt. Willard in 1886, '87, 1497.

CATAWBA RIVER, N. C. AND S. C.—EXAMINATION OF.

(Continued from Vol. I, p. 117.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '87, 139.

ENGINEER IN CHARGE.

Capt. C. B. Phillips, 1880. Report, '80, 911.

ASSISTANT.

J. M. Wolbrecht. Report, '80, 912, 913.

Plans.

Capt. Phillips, 1880, considers that from the necessary cost of the improvement the Government could not be expected to undertake it at present, '80, 912.

Surveys.

Ordered by act of June 18, 1878. Made, in 1880, under direction of Capt. C. B. Phillips, '80, 911.

Previous examination, in 1875, by S. T. Abert, '76, i, 374; '80, 912.

Examination ordered by act of August 5, 1886, '87, 139.

CATHANCE RIVER, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 118.)

Appropriations.

1880..... \$10,000, '80, 333.

1881..... 6,000, '81, 483.

1882..... 5,000, '82, 495.

Commerce.

Benefit to commerce from improvement, '81, 483.

Contracts.

1880. W. W. Wright, for dredging, at 27 cents per cubic yard, '81, 484; completed, '81, 482.

Eastern Dredging Company, for dredging, at 21 cents per cubic yard, '81, 484; completed, '82, 495.

1882. Kennebec Dredging Company, for dredging, at 34 cents per cubic yard, '83, 418; completed, '84, 465.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 65, 71; '81, 67; '82, 66; '83, 61; '84, 70.

CATHANCE RIVER, ME.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Col. George Thom, 1879-'83. Reports, '80, 332, 354; '81, 482; '82, 495.

Col. C. E. Blunt, 1883-'84. Reports, '83, 417; '84, 465.

ASSISTANT.

E. C. Jordan. Report, '80, 355.

Operations.

1880-'81. 31,347 cubic yards of material removed by dredging, '81, 482.

1881-'82. 27,922 cubic yards of material removed by dredging, '82, 495.

1882-'83. 9,450 cubic yards of material removed by dredging, '83, 417.

1883-'84. Contract with Kennebec Dredging Company, for dredging, completed, '84, 465. Improvement completed, '84, 465.

Projects.

By Col. Thom, 1879, for improvement of Cathance River, at its junction with the Kennebec, by dredging a channel with a depth of 10 feet at mean low water and a width of not less than 200 feet from the outlet of the river into Merry Meeting Bay, to the channel of the Kennebec River, near "The Chops," a distance of about $2\frac{1}{2}$ miles, at an estimated cost of \$25,000, '81, 67. Improvement completed, 1884, '84, 465.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under the direction of Lieut. Col. Thom, '80, 354, 355.

MAPS.

'80, 332.

CEDAR BAYOU, TEX.—EXAMINATION OF.

(Continued from Vol. I, p. 118.)

Commerce.

Transportation, '87, 1436.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 193.

ENGINEER IN CHARGE.

Maj. O. H. Ernst, 1887. Report, '87, 1435.

Physical Characteristics.

Deterioration of channel from natural causes, '87, 1436.

Plans.

Maj. Ernst, in 1887, considered the stream worthy of improvement, and estimates \$48,875 as cost of necessary excavation for channel, '87, 1436.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Ernst, '87, 1435.

CEDAR CITY, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**CEDAR KEYS TO CLEARWATER HARBOR, FLA.—EXAMINATION FOR CHANNEL BETWEEN.****Commerce.**

Small amount of, '84, 1220.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 206.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '84, 1220.

ASSISTANT.

Lieut. J. L. Lusk. Report, '84, 1220.

Physical Characteristics.

Route described, '84, 1220.

CEDAR KEYS TO CLEARWATER HARBOR, FLA.—Continued.**Plans.**

In 1883 Capt. Damrell reported that the cost of any improvement would be considerable, that the commerce to be benefited was small, and that there would be no advantage in the improvement, '84, 1220.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Damrell, '84, 1220.

CEDAR KEYS HARBOR, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 118.)

Appropriations.

1879.....	\$71,250
1880.....	15,000, '80, 1070.
1884.....	5,000, '84, 197.
1886.....	7,000, '86, 1149.

Total 98,250

1888..... 7,500, act of August 11, 1888.

Contracts.

1880. J. E. Slaughter, for dredging, at 69 cents per cubic yard, '80, 1070; completed, '81, 1180. J. E. Slaughter, for removing wreck of steamer Lewisburg, at \$1,999, '80, 1070; completed, '81, 1180.

1881. J. E. Slaughter, for dredging, at 67 cents per cubic yard; completed, '81, 1181.

1884. S. N. Kimball, for dredging and rock excavation, at \$1 and \$6.50, respectively, per cubic yard, '85, 1271.

1887. R. Moore, for dredging, at 45 cents per cubic yard, '87, 1252.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 133; '81, 181; '84, 206; '85, 196; '86, 195; '87, 161.

ENGINEERS IN CHARGE.

Capt. A. N. Damrell, 1873-'85. Reports, '80, 1069; '81, 1180; '84, 1218, 1220, 1223.

Capt. W. T. Russell, 1885-'86. Report, '85, 1270.

Lieut. W. M. Black, 1886-'— . Reports, '86, 1148; '87, 1251.

ASSISTANTS.

Lieut. J. L. Lusk. Report, '84, 1219, 1220.

H. Harding. Report, '84, 1226.

Operations.

1879-'80. Wreck of steamer Lewisburg removed and 14,273 cubic yards of material dredged on outer bar, '80, 1069.

1880-'81. 33,968 cubic yards of material dredged, '81, 1180, 1181.

1881-'85. Operations suspended, '86, 1149.

1885-'86. 370 cubic yards sand and 6,153 cubic yards stone removed, '86, 1149.

1886-'87. No operations, '87, 1252.

Projects.

Between 1872 and 1880 a channel 200 feet wide, 11½ and 12 feet deep, was formed through the middle ground and outer bar, '78, 589; '79, 813; '87, 1251.

By Capt. Damrell, 1884, for widening the channel formed in 1872-'81 through the middle ground to a width of 200 feet and depth of 10½ feet, by dredging and rock removal. Estimated cost, \$25,000, '85, 196, 1270. Revised in 1887 to \$66,000, on account of increased quantity of rock to be removed, '87, 1252.

Surveys.

Examination for harbor at Cedar Keys and also for channel inside the shoals along the coast of Florida, from Cedar Keys to Clearwater Harbor and Tampa, ordered by act of August 2, 1882. Made under direction of Capt. Damrell, and reported by him as unworthy of improvement and not a public necessity, '84, 1218, 1220.

Of harbor at Cedar Keys ordered by act of August 2, 1882. Made, 1884, under direction of Capt. Damrell, '84, 1224.

MAPS.

'86, 1149.

CEDAR POINT AND DAUPHIN ISLAND, ALA.—EXAMINATION OF SHOAL BETWEEN.

(See DAUPHIN ISLAND AND CEDAR POINT.)

CEDAR RIVER, MICH.—IMPROVEMENT OF MOUTH OF.**Appropriations.**

1882..... \$15,000, '82, 2119.
 1884..... 15,000, '84, 1834.

Commerce.

Statistics, '82, 2121, 2124; '86, 1650.

Requirements of commerce do not warrant continuation of work, '87, 2004.

Contracts.

1883. Green Bay Dredging Company, for pile-pier construction, '83, 1638.

1884. Green Bay Dredging Company, for dredging, '85, 1976. Schwarz & Berner, for pile-pier construction, '85, 1976.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 279; '82, 268; '83, 277; '84, 276; '85, 299; '86, 293; '87, 258.

ENGINEERS IN CHARGE.

Maj. H. M. Robert, 1881-'83. Report, '82, 2119, 2120.

Maj. J. W. Barlow, 1883, '83, 1629.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1637.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1833; '85, 1976.

Capt. W. L. Marshall, 1886, '86, 290.

Capt. C. E. L. B. Davis, 1886-'—. Reports, '86, 1650; '87, 2002.

ASSISTANT.

L. Y. Schermerhorn. Reports, '82, 2122; '83, 1639.

Operations.

1883-'84. 563 linear feet of pile-pier built, '84, 1833.

1884-'85. Pier construction in progress; 10,583 cubic yards material dredged from channel, '85, 1976.

1885-'86. Piers extended to an aggregate length of 1,054 feet, '86, 1650.

1886-'87. Operations suspended, '87, 2002, 2004.

Physical Characteristics.

Description of the locality, '82, 2120, 2122.

Description of shoal in front of entrance, '82, 2119, 2212; '83, 1639.

Projects.

By Maj. Robert, 1881, for the construction of two parallel piers 200 feet apart, extending from the outer ends of existing private piers to about the 16-foot curve in Green Bay; also the dredging of the channel between the piers to the depth of 14 feet. Estimated cost, \$138,000, '82, 2121, 2124. Change in direction of piers, '85, 1976.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Robert, '82, 2119.

MAPS.

Mouth of the river, '84, 1834.

CHAGRIN RIVER, OHIO—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 228; '81, 314.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson. Report, '81, 2339.

Maj. L. C. Overman. Report, '87, 2333.

Commerce.

No commerce at present to justify improvement, '81, 2340; '87, 2334.

Plans.

By Maj. Wilson, 1881, for diversion of stream into main channel by cutting off west branch at its head; also for two piers, 1,400 and 1,300 feet long, respectively, to extend into lake on either side of main channel, and for dredging between piers. Estimated cost \$200,420, '81, 2339, 2340. In 1886 Maj. Overman did not consider the mouth of the river worthy of improvement, '87, 2334.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Wilson, '80, 228.

Examination of mouth ordered by act of August 5, 1886. Made under direction of Maj. Overman, '87, 2333.

**CHANNEL BACK OF BRIGANTINE BEACH, N. J., between
Absocom and Brigantine Inlets—EXAMINATION OF.**

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 86.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1886. Report, '87, 821.

Plans.

Lieut. Col. Robert, 1886, reports the route as unworthy of improvement, in view of the small amount of commerce to be affected and difficulty in keeping the channel open, '87, 821.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Robert, '87, 821.

**CHANNEL BETWEEN LLOYD'S HARBOR AND COLD
SPRING BAY, N. Y.—SURVEY FOR OPENING.**

Commerce.

Justification of improvement, '81, 615.

Commercial statistics, '81, 615.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 80; '81, 96.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '81, 613.

ASSISTANT.

W. W. Starr. Report, '81, 614.

Plans.

By Maj. Barlow, 1882, for formation of dredged channel 200 feet wide and 10 feet deep at mean low water, with jetties at Cold Springs. Estimated cost, \$287,534.40, '81, 615.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Barlow, 1880, '81, 613.

CHARLESTON HARBOR, S. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 120.)

Appropriations.

1852-'79	\$544,700
1880.....	170,000, '80, 928.
1881.....	175,000, '81, 1053.
1882.....	300,000, '82, 1136.
1884.....	250,000, '84, 1085.
1886.....	187,500, '86, 1073.

Total 1,627,200

1888 (including Sullivan's Island) 350,000, act of August 11, 1888.

List of appropriations, '86, 1072.

Necessity for larger appropriations, '87, 1131.

Commerce.

Commercial necessity for improvement, '81, 1052; '87, 1130, 1137.

Contracts.

1879. Bangs & Dolbey, for construction of jetties in Charleston Harbor, S. C., '80, 928; completed, '81, 1044.

1880. F. P. Murphy, for riprap stone, at \$2.80 per cubic yard, on north jetty, '81, 1053; contract annulled, '81, 1044. N. A. Devereux, for laying courses composed of logs and brush overlaid with 1 foot of riprap stone; price per linear foot, \$10.73, '81, 1054; annulled, '82, 1131. Moses Dolbey, for work upon jetties, at \$13.45 per linear foot; completed, '81, 1054.

1882. A. A. Howlett, for mattress, at 72 cents per square yard, and riprap stone, at 59 cents per cubic yard, '83, 879; extension of contract, '83, 875; completion, '84, 1080.

CHARLESTON HARBOR, S. C.—Continued.**Contracts—Continued.**

1884. A. A. Howlett, for construction of jetties, at 67 cents per square yard for mattress and \$3.41 per cubic yard for stone, '85, 1182; contract completed, '86, 1069. H. H. Penny, for dredging between jetties, at 30 cents per cubic yard, '85, 1182; contract completed, '86, 1069.
1886. A. M. Bangs, for mattress, at 49 cents per square yard, and stone, at \$3.09 per cubic yard, '87, 1133.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 126; '81, 168; '82, 164; '83, 171, 882; '84, 178; '85, 177; '86, 176; '87, 140.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1880—'. Reports, '80, 921; '81, 1043; '82, 1129; '83, 873; '84, 1077; '85, 1172; '86, 1063; '87, 1125.

ASSISTANTS.

Capt. J. C. Post. Reports, '80, 929; '83, 880, 883.

Capt. B. D. Greene. Reports, '81, 1055; '82, 1136.

Lieut. T. N. Bailey. Reports, '83, 879; '84, 1085.

Lieut. F. V. Abbot. Reports, '85, 1182; '86, 1073; '87, 1133.

Operations.

1879-'80. North and south jetties in progress, '80, 927.

1880-'81. 35,789 cubic yards of stone deposited in north and south jetties; dredging on bar, '81, 1044, 1046, 1047.

1891-'82. North jetty extended 2,319 linear feet, south jetty extended 3,209 linear feet; spur-jetty built, '82, 1137; 28,387 cubic yards riprap stone deposited upon north jetty, '82, 1131; 23,030 cubic yards riprap stone deposited upon south jetty, '82, 1132.

1882-'83. Extension of bottom course of granite jetty 2,657 linear feet, and enlarging foundation course of work, '83, 875; 35,753 cubic yards of riprap stone placed in the work, '83, 876.

1883-'84. Bottom course of south jetty extended 816 linear feet seaward and 513 linear feet landward; 33,159 square yards log and brush placed; 17,299 cubic yards riprap stone laid over mattresses, '84, 178; 183 cubic yards of riprap stone distributed over portions of second spur-jetty, Sullivan's Island, '84, 1081.

1884-'85. Bottom course of south jetty extended 2,228 linear feet; 69,398 square yards log and brush mattress overlaid with 25,182 cubic yards of riprap stone; 8,929 cubic yards of material dredged between jetties; 952 linear feet of spur-dike built, '85, 178.

1885-'86. Work continued on north jetty; foundation of south jetty extended seaward 43 feet; ridge of riprap deposited upon existing work; 18,289 square yards of log and brush mattress and 15,341 cubic yards of riprap stone put in the two jetties; 76,620 cubic yards of material dredged between jetties, '86, 176, 177; the outer end of north jetty, 14,327 feet from Sullivan's Island and within 1,200 feet of the outer 18-foot curve; the outer end of south jetty, 16,440 feet from Morris Island and 2,500 feet from outer 18-foot curve, '80, 176.

1886-'87. 19,077 square yards of mattress and 13,277 cubic yards of stone added to north jetty; 18,621 square yards mattress and 9,508 cubic yards of stone added to south jetty; no additional extension seaward made. Total material used in the construction of the jetties, 480,814 square yards of mattress, 250,959 cubic yards of stone, '87, 1128, 1133.

Projects.

By Col. Gillmore, 1878, for the purpose of establishing and permanently maintaining a practicable channel across the bar of not less than 21 feet depth at mean low water, by means of two converging jetties of random stone on brush and log mattresses, with an opening between the ends of the jetties of about 2,900 feet. Estimated cost, \$3,000,000, '78, 558, 572; '86, 176; '87, 1135.

Surveys.

Field work and survey of outer and inner harbors and the bar, '82, 1130.

General survey of outer harbor, including the bar and its exterior slope, commenced, '83, 875; completed, '84, 1085. Examination into condition of north and south jetties, '84, 1081, 1088.

Resurvey of area between sea and portions of jetties, '85, 1177; '86, 1076; '87, 1132.

MAPS.

'80, 926; '81, 1052; '82, 1136; '83, 878; '84, 1088; '85, 1180; '86, 1076; '87, 1132.

CHARLESTON HARBOR, AT SULLIVAN'S ISLAND, S. C.— IMPROVEMENT OF.

Appropriations.

1880..... \$5,000, '80, 932.

Contracts.

E. T. Bangs, for jetty construction, '81, 1067.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 127; '81, 170.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1870. Reports, '80, 931; '81, 1064.

Operations.

1880-'81. 324 linear feet of log jetty built and covered with 495 cubic yards of riprap stone, '81, 1066.

Projects.

Lieut. Col. Gillmore, 1880, for protection of south shore of Sullivan's Island by construction of 3 log and riprap spur-jetties, varying from 150 to 180 feet in length, placed at right angles to the shore-line. Estimated cost, \$6,000, '80, 931.

CHARLESTON NECK, S. C., SHIP-CANAL ACROSS—EXAMINATION FOR.

Commerce.

Benefits to, arising from construction of canal, '81, 1165.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 132; '81, 179.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1880. Report, '81, 1164.

Physical Characteristics.

Geographical description of Charleston Neck and its surroundings, '81, 1165.

Plans.

By Capt. Post, for improvement of Charleston Neck by construction of canal of 20 feet depth at mean low water, a bottom width of 200 feet, with tide-gates at each end. Estimated cost, \$439,789, '81, 1167.

Private and Corporate Work.

Appropriation of \$15,000 by legislature of South Carolina towards construction of canal, '81, 1167.

Surveys.

Ordered by act of June 18, 1878, '80, 132.

Made, 1880, under the direction of Lieut. Col. Gillmore, 1880, '80, 132.

Location selected for ship-channel, '81, 1165.

CHARLEVOIX HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 122.)

Appropriations.

1876-'79	\$31,000
1880.....	10,000, '80, 2009.
1881.....	10,000, '81, 2198.
1882.....	10,000, '82, 2282.
1884.....	10,000, '84, 1972.
1886.....	10,000, '86, 1756.

Total .. 81,000

1888..... 12,500, act of August 11, 1888.

Contracts.

1880. N. G. Dodge, for dredging, at 14 cents per cubic yard, '81, 2199.

1881. C. Sutherland, for pier construction, '81, 2198.

1882. L. E. Allen, pier construction, '83, 1807.

1886. L. E. Allen, for dredging and pier construction, '87, 2178.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 214; '81, 289; '82, 284; '83, 292; '84, 293; '85, 315; '86, 309; '87, 277.

CHARLEVOIX HARBOR, MICH.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1873-'80. Report, '80, 214.

Maj. F. Harwood, 1880-'82. Reports, '80, 2007; '81, 2197.

Maj. D. P. Heap, 1882-'83. Report, '83, 2281.

Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1805; '84, 1971; '85, 2065; '86, 1755; '87, 2176.

Operations.

1879-'80. 5,083 cubic yards material dredged, 150 linear feet of north pier extension nearly finished, '80, 2007.

1880-'81. 165 linear feet pile revetment repaired, superstructure over north pier nearly completed, 8,203 cubic yards sand dredged from channel, '81, 2197.

1881-'82. 27,062 cubic yards material removed from channel, '82, 2281. 1,401 linear feet plank-beam revetment and 440 linear feet close pile revetment constructed; minor repairs to crib-work, '83, 2282.

1882-'83. 10,306 cubic yards material dredged from channel, '83, 1806.

1883-'84. Backing placed behind revetments, '84, 1972.

1884-'85. 161 feet plank-beam revetment repaired, 75 linear feet plank-beam revetment changed to close piling, channel face of south pier built up, 210 cords brush and 674 cords stone used in backing plank-beam revetment, '85, 2066.

1885-'86. 330 linear feet of superstructure completed, '86, 1756.

1886-'87. 3,360 cubic yards gravel dredged from lower channel, '87, 2176.

Projects.

By Maj. Mansfield, 1868, for improvement of harbor by dredging a channel 100 feet wide to a depth of 12 feet, both sides to be protected by close piling; modified in 1876 by the substitution of crib for pile-piers, at an estimated cost of \$186,000, '69, 80, 81, 82; '80, 214; '87, 2177.

Surveys.

Of upper and lower channels, 1883, '83, 1806.

MAPS.

'82, 2282; '83, 1806.

CHARLOTTE HARBOR, FLA.—EXAMINATION OF.**Commerce.**

Requirements of, '80, 1100; '85, 1286.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140; '85, 199; '87, 162.

ENGINEERS IN CHARGE.

Capt. A. N. Damrell. Report, '80, 1100.

Capt. W. T. Russell. Report, '85, 1286.

Lieut. W. M. Black. Report, '87, 1258.

ASSISTANT.

J. L. Meigs. Report, '80, 1101.

Plans.

In 1880 Capt. Damrell considered that Charlotte Harbor did not require improvement; that to improve Pease Creek from its mouth to Fort Meade would cost \$17,000, '80, 1100.

In 1884 Capt. Russell considered that there was no present need for the improvement of Charlotte Harbor, '85, 1286.

In 1887 Lieut. Black did not consider the harbor worthy of improvement, '87, 1258.

Surveys.

Examinations ordered by act of March 3, 1879, July 5, 1884, and August 5, 1886, '80, 1100; '85, 1286; '87, 1258.

CHARLOTTE HARBOR AND PEASE CREEK, FLA.—EXAMINATION OF.

(Continued from Vol. I, p. 123.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 140.

CHARLOTTE HARBOR AND PEASE CREEK, FLA.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Capt. A. N. Damrell, 1880. Report, '80, 1100.

ASSISTANT.

J. L. Meigs. Report, '80, 1101.

Plans.

By Capt. Damrell, 1880, for improvement of Pease Creek by rock excavation and removal of obstructions from its mouth to Fort Meade. Estimated cost, \$17,000, '80, 1100, 1103.

Surveys.

Ordered by act of March 3, 1879, '80, 140. Made under the direction of Capt. Damrell, '80, 1100.

CHARLOTTE HARBOR, FLA.—WATER-WAY FROM, TO SAINT JOHN'S RIVER, EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 179; '82, 175.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1880. Report, '82, 1204.

ASSISTANT.

W. G. Williamson. Report, '82, 1219.

Plans.

By Lieut. Col. Gillmore, 1882, for opening steam-boat communication from Saint John's River, Fla., by way of Tohopokeliga Lake, to Charlotte Harbor or Pease Creek, at an estimated cost of \$5,662,812, '82, 1216.

Surveys.

Ordered by act of June 14, 1880, '80, 132. Made under direction of Lieut. Col. Gillmore, 1882, '82, 1204.

CHARLOTTE HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 123.)

Appropriations.

1828-'79	\$310, 578. 40
1880.....	5, 000. 00, '80, 2207.
1881.....	2, 500. 00, '81, 2437.
1882.....	35, 000. 00, '82, 2445.
1884.....	20, 000. 00, '84, 2137.
1886.....	26, 250. 00, '86, 1888.

Total 399, 328. 40

1888..... 45, 000. 00, act of August 11, 1888.

List of appropriations from 1828 to 1881, '81, 2436.

Contracts.

1882. A. J. Packard, iron for pier extension, '83, 1943. J. W. Dennis, for labor and materials (except iron) for 600 linear feet of extension, '83, 1942; completed, '84, 2137.

1884. J. B. Donnelly, for construction of 350 linear feet of pier extension, '85, 2271; extended, '85, 2272; completed, '86, 1887.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 231; '81, 317; '82, 311; '83, 319; '84, 323; '85, 348; '86, 342; '87, 308.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1876-'83. Reports, '80, 2207; '81, 2436; '82, 2444.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1942; '84, 2137.

Capt. E. Maguire, 1885-'86. Reports, '85, 2271; '86, 1887.

Capt. C. F. Palfrey, 1886-'—. Report, '87, 2371.

Operations.

1879-'80. Repairs to east and west piers, '80, 2207.

1880-'81. Repairs to west pier; 707 feet of superstructure of east pier rebuilt, '81, 2436.

CHARLOTTE HARBOR, N. Y.—Continued.**Operations—Continued.**

- 1881-'82. 43 feet of east pier superstructure rebuilt, '82, 2444.
 1882-'83. No operations, '83, 1942.
 1883-'84. 16 cribs (30 feet in length) placed in east and west piers and 600 linear feet superstructure built over same, '84, 2137.
 1884-'85. One and one-half cribs framed, '85, 2272.
 1885-'86. 350 linear feet of pier extension completed, '86, 1887.
 1886-'87. 800 linear feet superstructure east pier built, '87, 2372.

Projects.

The projects of 1829-'80 were modified in 1881 by Maj. McFarland, to provide for an extension of the piers to the 15-foot curve in the lake, with the formation, by dredging, of a channel between the piers 15 feet deep. Estimated cost, \$154,000, '81, 2437; '86, 343.

Surveys.**MAPS.**

'81, 2436.

CHATTAHOOCHEE RIVER, GA. AND ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 125.)

Appropriations.

1835-'79	\$35,000
1880	20,000, '80, 1073.
1881	20,000, '81, 1188.
1882	25,000, '82, 1261.
1884	35,000, '84, 1167.
1886	20,000, '86, 1169.

Total 155,000

1888 20,000, act of August 11, 1888. |

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 134, 190; '81, 182, 189; '82, 177, 252; '83, 188; '84, 196; '85, 202; '86, 200; '87, 169.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1878-'80. Reports, '80, 1705; '82, 1875.

Maj. A. N. Damrell, 1880-'85. Reports, '80, 1070; '81, 1182; '82, 1259; '83, 973; '84, 1167.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1303; '86, 1168; '87, 1283.

ASSISTANTS.

B. W. Frobel. Report, '80, 1708.

D. L. Sublett. Report, '80, 1719.

Operations.

1879-'80. Barge, magazine boat, and scow built; 2,693 linear feet jetty built; 51 snags and 585 cubic yards rock removed, '80, 1071.

1880-'81. 2 barges built, 1 steamer repaired, 176 cubic yards rock removed, '81, 1183.

1881-'82. 640 snags and trees removed, 1,682 linear feet jetty built, and 77 linear feet repaired; 2,614 cubic yards rock removed, 960 cords brush fascines constructed, '82, 1259.

1882-'83. 292 snags and trees and 1,968 cubic yards rock removed; 2,060 linear feet jetty built, '83, 973.

1883-'84. 634 snags and trees and 2,531 cubic yards rock removed; 2,377 linear feet of brush jetties built; 2 barges, 2 skiffs, and 3 bateaux built, '84, 1168.

1884-'85. 1,100 snags, logs, and trees, 3 wrecks removed from channel, 3,764 cubic yards rock removed, '85, 1304.

1885-'86. 4,473 cubic yards rock removed; steam snag-boat completed and equipped, '86, 1168.

1886-'87. 1,733 logs and trees removed by United States snag-boat; 3,007 cubic yards of marl excavated at Uchee Shoals, '87, 1284.

Plans.

By Maj. King, 1880, for improvement of Chattahoochee River, by excavation of channel through ledges and bars, removal of isolated and projecting rocks, and the building of jetty-dams to contract the channel to its normal width. Also by the construction of locks and dams where the fall is too great to be overcome by open channel navigation. Estimated cost, \$6,403,811, '80, 1708, 1721.

CHATTAHOOCHEE RIVER, GA. AND ALA.—Continued.**Plans—Continued.**

By Maj. King, 1882, for improvement of the river between West Point and Bolton, a distance of 108 miles, giving slackwater navigation by dredging, wing and riprap dam construction, and the construction of 8 locks. Estimated cost, \$486,474, '82, 1876.

Projects.

By Capt. Damrell, 1873, for improvement of Chattahoochee River from its mouth to Columbus, 223½ miles, by the formation of a channel 100 feet wide and 4 feet deep at low water, by blasting, dredging, removal of snags and logs, and the construction of wing-dams, '73, 700; '80, 1070; '86, 200.

Original estimate stated as \$335,247.66; '86, 1169; '87, 1283.

Surveys.

Survey above Columbus ordered by act of June 18, 1878. Made under direction of Maj. King in 1880, '80, 1705.

Survey between West Point and Bolton ordered by act of March 3, 1879. Made in 1881 under direction of Capt. Damrell, '81, 189.

Examination of river between West Point and Bolton ordered by act of March 3, 1881. Made, 1882, under direction of Maj. King, '82, 1875.

MAPS.

'80, 1708.

CHEBOYGAN HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 127.)

Appropriations.

1871-'79	\$91,000
1880	6,000, '80, 2035.
1881	6,000, '81, 2242.
1882	10,000, '82, 2328.
1884	5,000, '84, 2036.
1886	15,000, '86, 1824.

Total	133,000
1888	15,000, act of August 11, 1888.

Contracts.

1880. Carkin, Stickney & Cram, for dredging, at 17 cents per cubic yard, '81, 2242.

1881. J. W. McGinn, for pier construction, '81, 2243.

1883. Carkin, Stickney & Cram, for dredging, '83, 1851.

1887. Green Bay Dredging Company, for dredging, at 11½ cents per cubic yard, '87, 2249.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 219; '81, 297; '82, 292; '83, 301; '84, 303; '85, 326; '86, 320; '87, 288.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1877-'83. Reports, '80, 2034; '81, 2241; '82, 2327.

Lieut. Col. O. M. Poe, 1883-'— . Reports, '83, 1850; '84, 2035; '85, 2128; '86, 1824; '87, 2247.

Operations.

1879-'80. 9,843 cubic yards dredged from channels, '80, 2035.

1880-'81. 12,369 cubic yards material dredged, '81, 2241.

1881-'82. 12,000 cubic yards material dredged from channel, '82, 2327; construction of pier-head crib, '82, 2328.

1882-'83. 25,000 cubic yards material removed, '83, 1850.

1883-'86. No operations, '84, 2035; '85, 2128; '86, 1824.

1886-'87. No operations; history of past operations and projects, '87, 2247.

Projects.

By Capt. Farquhar, 1870, for improvement of harbor by dredging channel 200 feet wide by 14 feet deep, from mouth of river to Cheboygan village and the protection of the channel by pile-piers with crib pier-heads. Estimated cost, \$395,000, '71, 185, 186; '80, 219; '87, 2247.

Revised project by Maj. Harwood, 1882, providing a uniform depth of 15 feet throughout channel and of basin opposite steam-boat landing, '82, 2328; '87, 2247.

CHEBOYGAN HARBOR, MICH.—Continued.**Projects—Continued.**

In 1885 Col. Poe reduced the estimate for present project to \$218,000, '85, 2123; '87, 2248.

Surveys.

Of channel, 1880, '80, 2035.

MAPS.

'82, 2323.

CHEESEQUAKES CREEK, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 128.)

Appropriations.

1880..... \$20,000, '80, 524.
1881..... 5,000, '81, 664.
1882..... 15,000, '82, 681.

Contracts.

1882. S. R. Cumming, for construction of revetment, '83, 570.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 107; '82, 108; '83, 104; '84, 110; '85, 101; '86, 106; '87, 73.

ENGINEERS IN CHARGE.

Col. J. Newton, 1879-'82. Reports, '80, 524; '81, 663; '82, 679.

Lient. Col. G. L. Gillespie, 1882-'86. Reports, '83, 569; '84, 735; '85, 743.

Lient. Col. W. McFarland, 1886. Report, '86, 743.

Lient. G. McC. Derby, 1886-'— Report, '87, 775.

ASSISTANT.

R. H. Talcott. Report, '80, 525.

Operations.

1882-'83. 2,000 linear feet of stone jetty constructed; channel dredged, '83, 569.

1883-'84. Rubble jetties raised by addition of 750 cubic yards stone, channel widened to 100 feet; 532 feet of sheet pile revetment built, '84, 736; no operations since 1884, '86, 765; '87, 775; history of improvements, '86, 763.

Physical Characteristics.

Described, '80, 526.

Projects.

By Col. Newton, 1879, to change the outlet into a direction at right angles to the beach and to sustain this direction by parallel jetties to strengthen the course of the stream and increase the depth to 4 feet at mean low water. Estimated cost, \$75,279, '80, 525, 527; '82, 680. Estimate revised in 1885 to \$90,000, '85, 743; '87, 743.

Surveys.

Ordered by act of March 3, 1879. Made in 1880, under direction of Col. Newton, '80, 525.

MAPS.

'82, 680.

CHEHALIS RIVER, WASH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 128.)

Appropriations.

1882..... \$3,000, '82, 2686.
1884..... 2,500, '84, 2276.
1886..... 2,500, '86, 2010.
1888..... 2,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 332; '81, 323; '82, 323; '83, 337; '84, 340; '85, 367; '86, 364; '87, 328.

ENGINEER IN CHARGE.

Capt. C. F. Powell, 1881-'— Reports, '82, 2686, 2687; '83, 2075; '84, 2276; '85, 2405; '86, 2009; '87, 2489.

ASSISTANT.

R. A. Habersham. Report, '82, 2688.

CHEHALIS RIVER, WASH.—Continued.**Operations.**

- 1883-'84. 1,611 logs, snags, and pieces of drift-wood removed, '84, 2277.
 1884-'85. 1,711 logs, snags, and pieces of drift-wood cut and removed, '85, 2405.
 1885-'86. No operations for lack of funds, '86, 2009.
 1886-'87. 293 logs and snags removed, '87, 2469.

Physical Characteristics.

Description of river and its obstructions, '82, 2687, 2690.

Projects.

By Capt. Powell, 1882, for removal of snags, logs, drift, and similar obstructions between Claquato and the mouth, a distance of 70 miles, giving a navigable channel of 3 feet for two-thirds of the year at an estimated annual cost of \$8,000, '82, 2687, 2688.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Powell, '82, 2686.

CERRYSTONE CREEK, VA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 151.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '84, 953, 955.

ASSISTANTS.

W. H. Kimberly. Report, '84, 955.

I. L. Seager. Report, '84, 954.

Plans.

In 1882 Capt. Turtle did not consider the stream worthy of improvement nor the work a public necessity, '84, 955.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Turtle, '84, 953, 955.

CHESAPEAKE AND DELAWARE BAYS—SURVEY OF SHIP-CANAL TO CONNECT.

(Continued from Vol. I, p. 129.)

Appropriations.

1873-'79 \$15,000
 1882 10,000, for survey, '82, 144.

Commerce.

Saving in time and distance by canal, '80, 715.

Commerce passing through Delaware and Chesapeake Canal, '82, 958.

Importance of the improvement, '83, 742.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 110; '81, 150; '82, 144; '83, 148, 725.

ENGINEER IN CHARGE.

Lient. Col. W. P. Craighill. Reports, '80, 713; '82, 950; '83, 726, 749.

ASSISTANTS.

N. H. Hutton. Report, '80, 717.

Capt. T. Turtle. Reports, '82, 950; '83, 727, 752.

M. Paret. Report, '83, 727.

Physical Characteristics.

Geological formation of peninsula, '80, 717.

Tidal observations, '80, 729.

Ice records in Chesapeake and Delaware bays, '80, 734; '82, 954, 959; '83, 744.

Results of borings, '83, 728.

Plans.

By Lient. Col. Craighill, 1879, for a ship-canal 26 feet deep at mean low water, 100 feet wide at bottom, and 178 feet wide at water-line, without locks, except tide-locks. The following locations were presented:

Choctank route, length of canal proper 37 $\frac{1}{10}$ miles. Estimated cost, \$16,500,000, '80, 715, 725.

CHESAPEAKE AND DELAWARE BAYS—Continued.**Plans—Continued.**

Wye route, length of canal 43 miles. Estimated cost, \$26,333,000, '80, 715, 725.

Queenstown route, length of canal 53½ miles. Estimated cost, \$37,225,000, '80, 715, 725.

Centerville route, length of canal 51 miles. Estimated cost, \$41,500,000, '80, 715, 725.

Southeast Creek route, length of canal 38½ miles. Estimated cost, \$25,000,000, '80, 715, 726.

Sassafras route, length of canal 16½ miles. Estimated cost, \$8,500,000, '80, 715, 726, 735, 736.

Map showing routes, '80, 716.

Additional consideration of Choptank and Sassafras routes, '82, 951.

In 1883, after additional examination and increasing the depth of the canal to 27 feet, the following estimates are presented:

Choptank route..... \$18,184,766, '83, 741.

Sassafras route..... 11,410,000, '83, 742.

Buck Creek route..... 7,605,471, '83, 742.

Maintenance of canal, '83, 747.

Private and Corporate Work.

Description of existing canal, '80, 713; '82, 957.

Protests of the Maryland and Delaware Ship-Canal Company against further surveys, '83, 751, 753, 761.

Specifications of the Maryland and Delaware Ship-Canal, '83, 758.

Surveys.

Previous surveys made, '80, 714; '83, 753.

MAPS.

'80, 716; '83, 742.

CHESTER, PA.—ICE-HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 94; '81, 121; '82, 120; '83, 119; '84, 128.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 584, 611; '81, 767.

Capt. W. Ludlow, 1882-'83. Report, '82, 755.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 617.

Maj. W. H. Heuer, 1884. Report, '84, 816.

ASSISTANT.

Capt. W. Ludlow. Report, '80, 612.

Operations.

No operations from 1880 to 1884.

Surveys.

Examination for ice-harbor at Marcus Hook and Chester ordered by act of March 3, 1879. Made, 1880, under direction of Col. Macomb, '80, 611.

CHESTER AND RIDLEY CREEKS, PA.—SURVEY AND IMPROVEMENT OF.**Appropriations.**

1881..... \$3,000, '81, 793.

1882..... 3,000, '82, 777.

Contracts.

1882. F. C. Somers, for dredging, at 52 cents per cubic yard, '83, 634.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 97; '81, 125; '82, 123; '83, 124.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1880-'82. Report, '81, 792, 793.

Capt. W. Ludlow, 1882-'83. Report, '82, 777.

Lieut. Col. G. Weitzel, 1883. Report, '83, 633.

ASSISTANT.

T. G. Locke. Report, '83, 634.

Operations.

1882-'83. 10,613 cubic yards material dredged; project completed, '83, 634.

CHESTER AND RIDLEY CREEKS, PA.—Continued.**Projects.**

By Col. Macomb, 1881, for improvement of Chester Creek, Pa., by dredging and removal of silt to a depth of 7 feet low water at the entrance, diminishing upward. Estimated cost, \$10,781, '81, 125, 794.

By request of city authorities dredging was confined to area between Second Street Bridge and mouth of creek, '83, 634; completed, 1883, '83, 634.

Surveys.

Of Chester and Ridley creeks, near their outlets into the Delaware, ordered by act of March 3, 1879. Made, 1880, under the direction of Col. Macomb, '81, 792.

CHESTER RIVER, MD.—IMPROVEMENT OF, AT KENT ISLAND NARROWS.

(Continued from Vol. I, p. 134.)

Appropriations.

1876-'79 \$28, 000
List of appropriations, '86, 866.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 100; '81, 132; '82, 130; '83, 134; '84, 141; '85, 133; '86, 130; '87, 93.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1878-'84. Reports, '80, 624; '81, 859; '82, 843; '83, 669; '84, 893.

W. F. Smith, U. S. Agent, 1884—'. Reports, '85, 884; '86, 866; '87, 838.

Operations.

None since 1878, at which time project was completed, '85, 133; '87, 838.

Projects.

By Lieut. Col. Craighill, 1874, for the improvement of this part of Chester River by the reopening of a channel formerly existing between Chester River and Eastern Bay, which had been shut up by a solid causeway, under the authority of the State of Maryland. Estimated cost, \$25,000, '75, ii, 64; '85, 133. Project completed at a cost of \$25,000 in 1878. No further work deemed necessary, '85, 133.

Surveys.

Resurvey of channel, 1880, '80, 624.

CHESTER RIVER, MD.—IMPROVEMENT OF, FROM SPRY'S LANDING TO CROMPTON.**Appropriations.**

1881 \$6, 500, '86, 866.
1882 6, 500, '82, 841.

Contracts.

1881. D. Constantine, for dredging, at 27 cents per cubic yard, '82, 841.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 111; '81, 150; '82, 129; '83, 133; '84, 141; '85, 133; '86, 130.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1880-'84. Reports, '81, 856; '82, 841; '83, 667; '84, 893.

W. F. Smith, U. S. Agent, 1884—'. Reports, '85, 884; '86, 866.

ASSISTANT.

H. Bacon. Report, '81, 856.

Operations.

History of previous operations, '84, 893.

1881-'82. Channel over shoals dredged 70 feet wide and 8 feet deep at low water, '82, 841.

1882-'83. Channel widened to 120 feet and project completed as originally proposed, '83, 133; '86, 130.

CHESTER RIVER, MD.—Continued.**Projects.**

By Maj. Craighill, 1881, for improvement of Chester River, from Spry's Landing to Crompton, by excavation of channel 120 feet wide and 8 feet deep at mean low water. Estimated cost, \$13,167, '81, 867; '83, 667. Project completed in 1883, '83, 133; '86, 130.

Surveys.

Of Chester River, between Kirby's and Spry's Landing, ordered by act of June 14, 1880. Made, 1881, under the direction of Maj. Craighill, '81, 150, 856.

CHEYENNE RIVER, DAK.—SURVEY OF.

(Continued from Vol. I, p. 135.)

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 170.

ENGINEER IN CHARGE.

Lieut. E. Maguire. Report, '80, 1478.

Plans.

Recommended that no appropriations be made, '80, 1478.

Surveys.

Of Cheyenne River ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Maguire, '80, 1478.

History of the work, '80, 1479.

CHICAGO HARBOR, ILL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 135.)

Appropriations.

1833-'79	\$1, 134, 005
1880	145, 000, '80, 1986.
1881	150, 000, '81, 2160.
1882	200, 000, '82, 2206.
1884	100, 000, '84, 1945.
1886	75, 000, '86, 1703.

Total 1, 804, 005

1888..... 200, 000, act of August 11, 1888.

Commerce.

Area of outer harbor, '82, 2204; '83, 1742; '84, 1944.

Collisions with exterior breakwater, '83, 1742; '84, 1944.

Commercial statistics, '87, 2116.

Contracts.

1879. G. Hannaha, for timber and piles, '80, 1984, 1986.

1880. Chicago Dredging and Dock Company, for dredging, at 21½ cents per cubic yard, '81, 216.

1881. G. Hannaha, for timber, '81, 2161. Shumway, Bergess & Co., for drift bolts, '81, 2161.

1882. W. E. Hutchinson, for timber, '82, 2206. G. Hannaha, for timber, '82, 2206. Beckford, Knox & Co., for timber, '82, 2206.

1883. A. H. Petrie & Co., for timber, '83, 1745. A. S. Packard, for timber, '83, 1745. Green Bay Dredging Company, for dredging, at 17½ cents per cubic yard, '83, 1745. Singer & Talcott Stone Company, for stone, '83, 1745.

1884. Chicago Dock and Dredging Company, for dredging, at 23½ cents per cubic yard, '85, 2050. C. E. Mitchell, for timber, '85, 2050. Leatham & Smith, '85, 2050.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 210, 212; '81, 285, 287, 2161; '82, 290, 2209; '83, 288; '84, 289; '85, 312; '86, 306; '87, 272.

CHICAGO HARBOR, ILL.—Continued.**Engineers—Continued.****BOARD OF ENGINEERS.**

Convened January, 1881, to examine and report on Maj. Lydecker's plan and location for exterior breakwater. Report, '81, 2162. (See **PROJECTS.**) (Cols. Tower and Newton and Lieut. Col. Abbot.)

Constituted by S. O. No. 31, C. of E., 1882, to consider and report upon the plans submitted by Illinois Central Railroad for docks and wharves fronting the outer harbor. Report, '82, 2234.

Recommendations of Board, '82, 2237.

(Lieut. Cols. Parke and Comstock and Maj. Weitzel.)

ENGINEERS IN CHARGE.

Maj. G. J. Lydecker, 1877-'82. Reports, '80, 1963; '81, 2151.

Maj. W. H. H. Benyaurd, 1882-'86. Reports, '82, 2203, 2207; '83, 1741; '84, 1943; '85, 2047; '86, 1701.

Maj. T. Handbury, 1886—'. Report, '87, 2109.

Legal Proceedings.

Matter relating to encroachment of railroads upon area of outer harbor, '82, 2207-2240; '87, 2110.

Operations.

1879-'80. 974 piles driven for crib foundation, 1,900 linear feet of crib-pier superstructure placed in extension of southerly breakwater, and 2,300 linear feet of superstructure built; undue settlement of last 4 cribs placed; work mainly done by hired labor and purchase in open market, '80, 1984.

1880-'81. 87 piles driven for crib foundations, 300 linear feet of crib substructure and 1,100 linear feet superstructure placed in southerly breakwater, thereby completing the proposed southerly breakwater, with a length of 3,000 linear feet, '81, 2151. 72,158 cubic yards material dredged in outer harbor, '81, 2152; '82, 2204.

1881-'82. 136,287 cubic yards material dredged from outer harbor, '82, 2204; 1,536 linear feet of exterior breakwater built, '82, 2204; '83, 1742.

1882-'83. 900 linear feet exterior breakwater built, '83, 1742.

1883-'84. 800 linear feet of exterior breakwater built and 100 linear feet repaired, '84, 1944; 65,758 cubic yards material dredged from outer harbor, '84, 1945.

1884-'85. 700 linear feet of exterior breakwater built, including 100 linear feet destroyed in 1881, with extensive repairs to cribs, '85, 2048; settlement of cribs, '85, 2048; dredging in progress in outer harbor, '85, 2049.

1885-'86. No operations from lack of funds; injury to southerly breakwater from gales, '86, 1702.

1886-'87. Repairs to breakwater, '87, 2112.

Private and Corporate Work.

Encroachment of railroads on harbor areas, '82, 2207.

Projects.

The work for the improvement of this harbor was commenced by the United States under its first appropriation in 1833 and continued at irregular intervals to 1864, and thereafter more regularly to 1870, at which latter date the basis of the present project was adopted. Between 1833 and 1870 the project consisted in the formation of a channel of entrance to mouth of the river between two piers extending into the lake, and between which a channel of about 14 feet was obtained. The amount appropriated from 1833-'69, inclusive, was \$446,005, '76, ii, 433; '79, 1555. Between 1870 and 1876 additional extensions were made to the north and south piers, '70, 96; '76, ii, 426, 435.

In 1870 the project for an outer harbor was adopted, contemplating the construction of an easterly breakwater 4,000 feet long about 3,300 feet from the shore, and a southeasterly breakwater about 3,000 feet long, the protected area being about 455 acres, of which 185 acres were reserved for piers and slips, and 270 acres with a depth dredged to 16 feet, for harborage, '70, 101, 124; '76, ii, 435; '79, 1555; '86, 1702.

In 1878 the project was further modified by an additional breakwater about 5,400 feet long, and to be placed north and east of the harbor entrance, '79, 1561; '81, 2153, 2162; '86, 306.

The amount appropriated from 1870-'86, inclusive, has been \$1,358,000, and in 1886 it was estimated that \$240,000 was required to complete existing project, '86, 1703; '87, 2113.

Surveys.

Of Chicago River and north and south branches ordered by act of June 14, 1880, '80, 212.

Survey of harbor made 1882, '83, 1743.

MAPS.

Of harbor, '80, 1984; '81, 2158; '82, 2206; '83, 1744; '84, 1944; '85, 2050; '86, 1702; '87, 2112.

CHICAGO RIVER, ILL.—SURVEY OF NORTH AND SOUTH BRANCHES OF.**Commerce.**

Importance of the improvement, '81, 2165.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 212.

ENGINEER IN CHARGE.

Maj. G. J. Lydecker. Report, '81, 2165, 2167.

Physical Characteristics.

Description of river, '81, 2165, 2167.

Plans.

Maj. Lydecker in 1880 estimated that the formation of a dredged channel 175 feet wide and 17 feet deep between the mouth of the river and the junction of the north and south branches would cost about \$27,750, and for that part of the north branch above the junction to furnish a channel 200 feet wide and 15 feet deep the cost would be about \$285,000, but considered that such an improvement should be made by and at the cost of the private and local interests involved, '81, 2165, 2168.

Surveys.

Ordered by act of June 14, 1880, '80, 212. Made under direction of Maj. Lydecker, 1880, '81, 2165.

CHICKAHOMINY RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 137.)

Appropriations.

1878-'79	\$6,000
1880	2,000, '80, 779.
1881	2,000, '81, 975.
1882	5,000, '82, 1043.
1886	4,000, '86, 145.

Total..... 19,000

1888..... 2,500, act of August 11, 1888.

List of appropriations, '86, 921; '87, 949.

Contracts.

1880. H. E. Culpepper, for dredging, at 15 cents per cubic yard, '81, 974.

1882. J. Caler & Son, for dredging, at 22½ cents per cubic yard, '83, 823.

1886. H. E. Culpepper, for dredging, at 14½ cents per cubic yard, '87, 948.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 115; '81, 156; '82, 151; '83, 157; '84, 159; '85, 150; '86, 145; '87, 111.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1874-'— Reports, '80, 778; '81, 973; '82, 1041; '83, 823; '84, 996; '85, 987; '86, 920; '87, 947.

Operations.

History of operations, '82, 1041; '86, 921.

1880-'81. 16,933 cubic yards material dredged from channel, '81, 974

1882-'83. 19,859 cubic yards dredged, '83, 824.

1883-'86. No operations, '86, 920.

1886-'87. 18,299 cubic yards dredged from bars, '87, 948.

Physical Characteristics.

Obstructions in channel of river, '82, 1041.

Description of original condition of river, '86, 920.

Projects.

By S. T. Abert, 1878, for improvement of Chickahominy River by excavation of channels 100 to 150 feet wide through Binn's, Old Fort, Windsor Shades Bars, to a depth of 8 feet at low water. Estimated cost, \$15,000, '79, 619; '80, 115. Increased, 1882, for channel through bar at mouth, \$18,000, '82, 1043. Increased, 1885, \$1,000, '85, 988.

In 1887 it was estimated that \$10,000 was required to complete the project, '87, 949.

MAPS.

'87, 948.

CHICAMUXEN CREEK, MD.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1005.

Plans.

In 1882 Mr. Abert considered that the improvement could not be regarded as a public necessity, '84, 1006.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of S. T. Abert, '84, 1005.

CHINCOTEAGUE BAY TO DELAWARE BAY—SURVEY AND IMPROVEMENT OF INLAND WATER-WAY BETWEEN.

(Continued from Vol. I, p. 138.)

Appropriations.

1886..... \$18,750, '87, 836.

1888..... 50,000, act of August 11, 1888.

Commerce.

Justification of improvement, '85, 891, 895.

Engineers.

CHIEF OF ENGINEERS.

Reports, '85, 137; '87, 91.

ENGINEER IN CHARGE.

W. F. Smith, U. S. Agent. Reports, '85, 891, 897, 899; '87, 836.

ASSISTANT.

C. M. Bird. Report, '85, 891, 898, 900.

Physical Characteristics.

Description of route, '85, 892, 902.

Plans.

By W. F. Smith, 1885, for an inland navigation between Chincoteague and Delaware bays, a distance of 73 miles, by the formation, where necessary, of a dredged channel 70 feet wide and 6 feet deep at mean low water. Estimated cost, \$350,000, '85, 897, 899, 904.

Surveys.

Examination ordered by act of July 5, 1884. Made under the direction of W. F. Smith, '85, 891, 897, 899; '87, 836.

CHINCOTEAGUE INLET, VA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '80, 110.

ENGINEER IN CHARGE.

Maj. W. P. Craighill. Report, '80, 742.

Physical Characteristics.

Description of Chincoteague Inlet and vicinity, '80, 742.

Plans.

By Maj. Craighill, 1880, for improvement of Chincoteague Inlet between Franklin and Chincoteague Island, by excavation of channel 200 feet wide and from 6 to 8 feet deep at mean low water. Estimated cost, \$61,250 to \$143,750, respectively, '80, 743.

Surveys.

Ordered by act of March 3, 1879, '80, 110. Made, 1880, under direction of Maj. Craighill, '80, 742.

CHIPOLA RIVER, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 140; '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1304.

ASSISTANT.

H. Haines. Report, '82, 1305.

Plans.

By Capt. A. N. Damrell, 1881, for improvement of Chipola River from Marianna to the Apalachicola River by dredging and removal of obstructions. Estimated cost, \$21,000, '82, 1304.

Surveys.

Ordered by act of June 14, 1880, '80, 140. Made under the direction of Capt. Damrell, '82, 1304.

CHIPPEWA RIVER, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 138.)

Appropriations.

1876 to 1879.....	\$34,464.86
1880.....	10,000.00, '80, 1577.
1881.....	10,000.00, '81, 1749.
1882.....	35,000.00, '82, 1811.
1884.....	15,000.00, '84, 1601.
1886.....	18,750.00, '86, 1488.

Total..... 123,214.86

1888 (Including Yellow Banks), \$10,000.00 act of August 11, 1888.

List of appropriations, '86, 1487.

Contracts.

Simar & Morton, for construction of dams, brush and stone shore protection, '81, 1750.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 179; '81, 241; '82, 238; '83, 245; '84, 246; '85, 268; '86, 268; '87, 225, 229.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878— Reports, '80, 1575; '81, 748; '82, 1810; '83, 1439; '84, 1600; '85, 1734; '86, 1486; '87, 1699, 1726.

ASSISTANTS.

G. Wells. Report, '80, 1577.

A. O. Powell. Report, '84, 1602.

V. D. Simar. Report, '85, 1735.

A. Johnson. Report, '87, 1729.

Legislation.

Required to prevent injury to navigation by bridge construction, '83, 1440.

Operations.

1879-'80. 1,360 linear feet brush and stone dams to close channel behind Flower Pot Island, and chute behind Little Missouri Island; 290 feet of base laid for dam at Flower Pot Cut-off; repairs to 950 feet of west jetty, '80, 1575.

1880-'81. Repairs to existing works, '81, 1748.

1881-'82. 1,108 cords brush and 6,603 cubic yards stone placed in brush and stone dams; 40 cubic yards of earth excavated, '82, 1810.

1882-'83. 7,736 cubic yards stone and 2,746 cords of brush put into 650 linear feet of work, '83, 1439.

1883-'84. 611 cords brush and 1,142 cubic yards stone placed in dams; excavation of bar at Flower Pot Cut-off Dam, '84, 1602.

1884-'85. 2,938 cubic yards stone and 3,943 of brush placed in dams; repairs to east and west jetties, and to Flower Pot Dam, Battle Island Dam, Dead Lake Cut-off Dam, and Three Mile Prairie revetment; 1,000 linear feet of jetty constructed and obstructions removed from Shaw's Rapids, '85, 1734.

1885-'86. Repairs to west jetty by hired labor, '86, 1486. List of dams, jetties, and revetments constructed and kept in repair from 1877 to 1886, '86, 1487.

1886-'87. Dam construction at Eau Claire, Five Mile Bluff Bar, and Twin Islands, '87, 1,700.

CHIPPEWA RIVER, WIS.—Continued.**Physical Characteristics.**

Unprecedented high water, '80, 1578. Description of river obstructions, '80, 1578.
Causes of extraordinary overflows on the Chippewa and Wisconsin rivers, '87, 1726.

Projects.

By Maj. Farquhar, 1875, for improvement of Chippewa River, Wis., from Eau Claire to the mouth, by dredging, construction of wing-dams, and removal of obstructions. Estimated cost, \$139,892.50, of which amount \$64,102.50 was estimated as the cost of protecting the "Yellow Banks" from erosion, '77, 574; '80, 179.

Estimate revised in 1883 by omitting cost of work at Yellow Bank and increasing the cost of the remaining work to \$132,476, '83, 1440; '87, 1699. From 1876 to 1886, inclusive, \$116,750 was appropriated. Estimated cost of completion of existing project in 1887, \$55,523, '87, 1701, 1702.

Surveys.

Examination of river between Eau Claire and mouth, '80, 1575.

Of headwaters in connection with reservoirs on the sources of the Mississippi River, '80, 1607, 1624; '81, 1781.

Examination of causes of overflow of the Chippewa and Wisconsin rivers ordered by act of August 5, 1886. Made under direction of Maj. Allen, '87, 1726.

MAPS.

'81, 1748; '83, 1440.

Flower Pot Island to Mississippi River, '87, 1702.

Seven Mile Bluff to Dark Slough, '87, 1702.

At Eau Claire, '87, 1702.

CHIPPEWA RIVER AT YELLOW BANKS, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 138.)

Appropriations.

1882..... \$30,000.00, '83, 1443.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 245; '84, 246; '85, 269; '86, 259; '87, 226.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1883.— Reports, '83, 1442; '84, 1603; '85, 1737; '86, 1489; '87, 1703.

ASSISTANT.

A. O. Powell. Report, '84, 1605.

Operations.

1882-'83. Bank protection in progress at Waubeek, '83, 1442.

1883-'84. Bank protection completed at Waubeek, Ramsey's, and Mary Dean banks, '84, 1604; '86, 1489.

1884-'85. Repairs to Waubeek Bank protection, '85, 1738.

1885-'87. No operations for lack of funds, '86, 1489; '87, 1704.

Projects.

By Maj. Allen for the protection of about 26,000 linear feet of river bank at five points below Eau Claire. Estimated cost, \$96,000, '83, 1442; '86, 1489.

CHOCTAWHATCHEE RIVER, FLA. AND ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 139.)

Appropriations.

1832-'79	\$31,000
1880	7,000, '80, 1079.
1881	10,000, '81, 1197.
1882	20,000, '82, 1275.
1884	15,000, '84, 1184.
1886	15,000, '86, 1177.

Total 98,000

1888..... 10,000, act of August 11, 1888.

List of appropriations from 1874 to 1880, '81, 1194.

CHOCTAWHATCHEE RIVER, FLA. AND ALA.—Continued.**Commerce.**

Amount of, to be benefited by improvement, '80, 1080.

Increase of, consequent upon improvement, '81, 1195.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 136, 140; '81, 184; '82, 180; '83, 190; '84, 198; '85, 205; '86, 203; '87, 165.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1873-'85. Reports, '80, 1079, 1081; '81, 1194; '82, 1270; '83, 988; '84, 1180.

Capt. R. L. Hoxie, 1886—'. Reports, '85, 1311; '86, 1176; '87, 1271.

ASSISTANT.

H. Haines. Report, '80, 1081.

Operations.

1879-'80. 20 miles of river between Geneva and mouth cleaned of snags and obstructions; cut-off opened; Buzzard Bar Cut-off cleaned out; portion of wreck of steamer *Boston* removed, '80, 1079.

1880-'81. 14,256 snags, stumps, and trees removed; 252 cubic yards sand excavated, '81, 1195.

1881-'82. 10,169 snags, stumps, etc., removed; 330 yards of bank protected by brush, '82, 1272.

1882-'83. 34 miles wholly and 161 miles partially improved by removal of 15,074 snags and trees, protection of 4,940 linear yards of bank, and closure of 6 cut-offs, '83, 990.

1883-'84. 29,819 snags, stumps, and trees removed; 990 linear feet bank protected, '84, 1181.

1884-'85. Operations of snag-boat '85, 1311.

1885-'86. 8,787 snags, logs, and trees removed, clearing 32 miles of river, '86, 1176. Improvement completed from mouth of river to a distance of 27 miles above Geneva, '86, 1176.

1886-'87. Operations of snag-boat; removal of rock and bowlders, '87, 1272.

Physical Characteristics.

Description of river obstructions, '80, 1081.

Projects.

By Col. Simpson, 1872, for improvement of Choctawhatchee River from its mouth to Geneva, a distance of 212 miles, by removal of snags, sunken logs, etc. Estimated cost, \$44,332, '74, 896; '81, 1194.

By Maj. Damrell, 1880, for improvement of Choctawhatchee River from Geneva to Newton, a distance of 40 miles, by removal of obstructions and construction of 3 locks and dams. Estimated cost, \$78,500, '80, 1081, making an aggregate of \$122,832 for the improvement of the river from its mouth to Newton, '86, 1177; '87, 1272.

Surveys.

Examination from Geneva to Newton ordered by act of March 3, 1879. Made under the direction of Capt. Damrell, 1880. Recommendation to defer improvement, '80, 1081.

CHOPTANK RIVER, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 141.)

Appropriations.

1880.....	\$5,000, '80, 636.
1881.....	5,000, '81, 874.
1882.....	5,000, '82, 852.
1884.....	5,000, '84, 902.
1886.....	10,000, '86, 869.

Total 30,000

1888..... 7,500, act of August 11, 1888.

Statement of appropriations, '87, 841.

Contracts.

1880. D. Constantine, for dredging, at 23 cents per cubic yard, '81, 875.

1881. D. Constantine, for dredging, at 27½ cents per cubic yard, '81, 876.

1882. D. Constantine, for dredging, at 27½ cents per cubic yard, '83, 677.

1884. Morris & Cumings, for dredging, at 21 cents per cubic yard, '85, 887.

1886. T. P. Morgan, for dredging, at 16 cents per cubic yard, '87, 840.

CHOPTANK RIVER, MD.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 102; '81, 135; '82, 131; '83, 136; '84, 144; '85, 134; '86, 131; '87, 94.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1879-'85. Reports, '80, 634; '81, 874; '82, 851; '83, 676; '84, 901.

W. F. Smith, U. S. Agent, 1885-'— . Reports, '85, 886; '86, 868; '87, 840.

ASSISTANT.

G. W. Parsons. Report, '81, 876.

Operations.

1881-'82. 32,071 cubic yards material dredged, '82, 852.

1882-'83. 450 feet of channel, 22 feet wide and 6 feet deep, dredged, '83, 677; 1,250 feet of channel, 22 feet wide, with a depth of 5 feet at mean low water, dredged through shoal below Cose's, '84, 901.

1883-'84. No operations for lack of funds, '84, 902.

1884-'85. Additional width of 25 feet given to the 22-foot cut throughout its length, '85, 135.

1885-'86. No operations for lack of funds.

1886-'87. 1,671 cubic yards dredged from channel, '87, 841.

Physical Characteristics.

River dimensions and bridge-crossings, '80, 634, 635.

Projects.

By Lieut. Col. Craighill, 1880, for the formation of a dredged channel 75 feet wide and 8 feet deep at mean low water between Denton and Gainsborough. Estimated cost, \$79,000, '80, 636; '87, 94.

Surveys.

Ordered by act of March 3, 1879, '80, 102. Made between Denton and Greensborough, 1880, under the direction of Maj. Craighill, '80, 634.

CHRISTIANA RIVER, DEL. (See WILMINGTON HARBOR, DEL.)

(Continued from Vol. I, p. 594.)

CINCINNATI, OHIO—ICE-HARBOR.

(Continued from Vol. I, p. 141.)

Appropriations.

1878-'79	\$50,000
1882	16,000, '82, 1934.
1884	17,000, '84, 263.
1886	11,250, '86, 1550.

Total 94,250

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 194; '81, 262; '82, 256; '83, 265; '84, 263; '85, 284; '86, 275; '87, 241.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1878-'—. Reports, '80, 1788; '81, 1948; '82, 1934; '83, 1557; '84, 1703; '85, 1825; '86, 1549; '87, 1822.

Operations.

1879-'80. Dike on Ohio side extended to full length of 2,135 linear feet; Kentucky dike located and work commenced, '80, 1783.

1880-'81. Ohio dike finished and Kentucky dike partially completed, '81, 1948.

1881-'84. No operations.

1884-'85. 450 linear feet of dike built, '85, 284.

1885-'86. 2,050 linear feet of dike built, completing second dike, '86, 1549.

1886-'87. Construction of the third dike at Four-Mile Bar, '87, 823.

CINCINNATI, OHIO—Continued.**Projects.**

By Maj. Merrill, 1878, for protection from ice floes by construction of dikes at Four Mile Bar. Estimated cost, \$18 per linear foot, '79, 1364.

By Maj. Merrill, 1881, for a third dike at Four Mile Bar 2,200 feet in length. Estimated cost, \$33,000, '81, 1949.

CLARION RIVER, PA.—SURVEY OF.**Commerce.**

Lumber statistics, '82, 1938, 1944.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 263; '82, 257.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '82, 1938.

ASSISTANT.

J. Worrall. Report, '82, 1939.

Physical Characteristics.

Description of river, '82, 1938, 1939, 1942.

Plans.

Maj. Merrill considered in 1881 that until the Allegheny River had been radically improved there was but small need of improvement of its tributaries except to keep open navigation by the removal of rocks and similar obstructions, which could be done on Clarion River at an estimated cost of \$40,000, '82, 1938, 1941.

Surveys.

Ordered by act of March 3, 1881. Made under direction of Maj. Merrill, 1881, '82, 1938.

CLARK'S CREEK, S. C.—SURVEY OF.

[\$2,500 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 139.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1887-'—. Report, '87, 1109, 1110.

Physical Characteristics.

Description, '87, 1109.

Plans.

By Capt. Bixby, 1887, for improvement of the creek by removal of fallen and leaning trees, at a cost of \$7,500, '87, 1111.

Surveys.

Ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Bixby, '87, 1610.

CLEAR LAKE, CAL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 334.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '84, 2210.

ASSISTANT.

Lieut. C. F. Palfrey. Report, '84, 2210.

Physical Characteristics.

Description of Clear Lake, '84, 2211.

CLEAR LAKE, CAL.—Continued.**Plans.**

In 1882 Col. Mendell considered that the requirements of commerce did not make the improvement a public necessity, '84, 2210.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Col. Mendell, '84, 2210.

CLEARWATER HARBOR, FLA.—SURVEY OF.**Commerce.**

Commercial statistics, '85, 1325, 1328.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 207; '87, 162.

ENGINEERS IN CHARGE.

Capt. R. L. Hoxie. Report, '85, 1323, 1324.

Capt. W. M. Black. Report, '87, 1239.

ASSISTANTS.

H. Haines. Report, '85, 1324.

J. L. Meigs. Report, '85, 1326.

Physical Characteristics.

Locality described, '85, 1326.

Plans.

By Capt. Hoxie, 1885, for the formation of a dredged channel 5½ feet deep at low water through Sand Key Bar and Dunedin and Clearwater channels. Estimated cost, \$11,553, '85, 1325, 1328.

In 1887 Capt. Black did not consider the locality worthy of improvement, '87, 1260.

Surveys.

Examination ordered by acts of July 5, 1884, and August 5, 1886. Made under the direction of Capt. Hoxie in 1885, '85, 1323; and Capt. Black in 1887, '87, 1259.

CLEARWATER HARBOR TO CEDAR KEYS, FLA.—CHANNEL BETWEEN.

(See CEDAR KEYS AND CLEARWATER HARBOR, FLA.)

CLEARWATER RIVER, IDAHO—IMPROVEMENT OF.

(Continued from Vol. I, p. 142.)

Appropriations.

1879..... \$5,000
1880..... 5,000, '80, 2330.
1882..... 5,000, '82, 2678.
Statement of appropriations, '87, 2524.

Commerce.

Benefit of improvement to timber interest, '80, 2329.

Contracts.

1880. S. R. Smith, for rock removal, at \$38 per cubic yard, '80, 2330.

1881. Holmes & Chalmers, for rock and stone removal, at \$31 and \$4, respectively, per cubic yard, '83, 2062.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 240; '81, 329; '82, 322; '83, 335; '84, 341; '85, 371; '86, 360; '87, 332.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1879-'81. Reports, '80, 2328; '81, 2587.

Capt. C. F. Powell, 1881-'85. Reports, '82, 2678; '83, 2061; '84, 2279.

Maj. W. A. Jones, 1885-'—. Reports, '85, 2439; '86, 1952; '87, 2523.

CLEARWATER RIVER, IDAHO—Continued.**Engineers—Continued.****ASSISTANT.**

P. G. Eastwick. Report, '84, 2281.

Operations.

1879-'80. Channel 60 feet wide and 4½ feet deep at low water excavated by blasting through Reuben's Rapids, '80, 2328, 2329.

1880-'81. 97.5 cubic yards solid rock and 250 cubic yards cobble-stone removed, '81, 2588.

1-'81-'83. No operations for lack of funds.

1883-'84. 154 cubic yards rock excavated, '84, 2279.

1884-'87. No operations for lack of funds, '85, 2439; '86, 1952; '87, 2523.

Plans.

By Capt. Powell, 1884, for rock removal and wing-dam construction from mouth of river to Clearwater Forks, 40 miles. Estimated cost, \$87,000, '84, 2280.

Projects.

By Maj. Wilson, 1878, for removal of rock and boulders from Lewiston to mouth of North Fork, forming a channel 60 to 75 feet wide with a depth of 4 to 5 feet at low water. Estimated cost, \$34,424, '79, 1816, 1823; '80, 240; '87, 2523.

Surveys.

At Reuben's Island Rapids and Kent's Chute, 1883, '83, 2061.

MAPS.

'80, 2328; '81, 2588.

CLEVELAND, OHIO—EXAMINATION OF OLD RIVER BED AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '84, 318; '85, 344, 2249.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson. Report, '84, 2110.

Maj. L. C. Overman. Report, '85, 2249.

Physical Characteristics.

Old river bed described, '84, 2110; '85, 2250.

Plans.

In 1882 Maj. Wilson considered that the old river bed was worthy of improvement, but that the work was not a public necessity at that time, '84, 2111.

In 1885 Maj. Overman considered the work was worthy of improvement, '85, 2151.

The Chief of Engineers considered that the desired improvement would be more of a local convenience than a public necessity, and therefore questionable whether it should be made at the expense of the United States, '85, 2249.

Surveys.

Examinations ordered by act of August 2, 1882, and July 5, 1884. Made under the directions of Maja. Wilson and Overman, '84, 2110; '85, 2249.

CLEVELAND HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 142.)

Appropriations.

1825-'79	\$654,881.61
1880	125,000.00, '80, 2144.
1881	200,000.00, '81, 2314.
1882	175,000.00, '82, 2401.
1884	100,000.00, '84, 2103.
1886	93,750.00, '86, 1868.

Total 1,348,631.61
1888 100,000.00, act of August 11, 1888.

Contracts.

1879. O. Sherwood and J. Geissendorfer, for breakwater construction, '80, 2145.
G. Worthington & Co., for iron, '80, 2145.

1880. P. Smith, for dredging, at 30 cents per cubic yard, '80, 2146. J. Barrett, for iron, '81, 2314. J. C. Williams, for breakwater construction, '81, 2315.

CLEVELAND HARBOR, OHIO—Continued.**Contracts—Continued.**

1881. J. Stang, for pile protective works, '81, 2315. C. G. Hubbell, for iron, '81, 2316. Sherwood, Strieberger & Geissendorfer, material and workmanship, '81, 2317.
1882. W. H. McCurdy, for iron, '83, 1909. L. P. & J. A. Smith, for materials and labor, '83, 1910. W. P. Stanton, for drift-bolts and boat-spikes, at $2\frac{1}{2}$ cents and $2\frac{1}{2}$ cents per pound, respectively, '83, 1910.
1884. J. Stang, for repair of lake-arm of breakwater, '85, 2232.
1885. L. P. & J. A. Smith, for filling stone, at \$5.50 per cord, '86, 1868.
1886. L. P. & J. A. Smith, for foundation stone for breakwater, '87, 2318, 2322.
1887. L. P. & J. A. Smith, for breakwater construction, '87, 2318, 2322. B. S. Horton, for construction of breakwater parapet, '87, 2319, 2322.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 226; '81, 309; '82, 304; '83, 312; '84, 315; '85, 340, 2232, 2233; '86, 344; '87, 300.

BOARD OF ENGINEERS.

Constituted by S. O. No. 98, 1884, Corps of Engineers (Lieut. Cola. McFarland and Wilson and Maj. Overman), '85, 2234.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2135; '81, 2310; '82, 2396.

Maj. L. C. Overman, 1883-'— . Reports, '83, 1905; '84, 2097; '85, 2227; '86, 1863; '87, 2317.

Operations.

History of the work from 1825 to date, '80, 2135.

1879-'80. 800 linear feet crib-work sunk, 1,054 linear feet superstructure built, 208 cubic yards stone placed in pile portion of breakwater, 550 linear feet foundation completed upon new breakwater, '80, 2142; 737 linear feet west pier superstructure rebuilt, 80 linear feet east pier repaired, 12,802 cubic yards material dredged at mouth of Cuyahoga River, '80, 2143.

1880-'81. Method of breakwater construction: 700 linear feet crib-work sunk and 700 linear feet of superstructure built, '81, 2312.

1881-'82. 620 linear feet pile protection built, repairs to 541 linear feet of east pier and 500 linear feet of west pier, 700 linear feet superstructure filled with stone, 350 linear feet ripped with heavy stone, 1,800 linear feet foundation completed, 1,100 linear feet crib-work, '82, 2399, 2400. Abstract of materials used in construction of 1,004 linear feet of breakwater, '82, 2403.

1882-'83. Repairs to U. S. boat-house, 4,000 cubic yards material dredged between piers, minor repairs to new breakwater, 950 linear feet foundation built, 1,600 linear feet crib-work sunk, 1,350 linear feet superstructure completed, '83, 1906, 1907, 1908.

1883-'84. 21,122 cubic yards material dredged from between piers, repairs to breakwater injured by collision, repairs to settled part of breakwater, 505 linear feet foundation built, 950 linear feet crib-work placed, 1,900 linear feet of breakwater ripped, 1,912 linear feet superstructure built, '84, 2098, 2099, 2100, 2101. Project of 1875 completed, '85, 2228.

1884-'85. 163 linear feet decking of east pier renewed, 80 feet of decking of west pier renewed. Repairs to east pier cribs, repairs to U. S. Engineers' boat-house, repairs to breakwater, junction of crib top, and lower course of superstructure closed by boiler-iron plating, '85, 2228, 2229.

1885-'86. 988 cords stone placed in lake-arm superstructure, '86, 1864. 150 cross-ties spliced and replaced, 2,120 tons stone placed in breakwater, '86, 1865.

1886-'87. Progress on formation of foundation of breakwater, repairs to piers and breakwater, '87, 2318.

Projects.

History of projects previous to 1875, '80, 2135; '87, 2317.

By Board of Engineers, 1875, improvement of Cleveland Harbor by construction of breakwater on west side of mouth of Cuyahoga River. Estimated cost, \$1,800,000, '80, 2141, 2143; '85, 2228. Modification by Chief of Engineers, '75, i, 303; '80, 2141. Completed in 1883, at a cost of \$300,000, '85, 2228. Modified in 1884 by Board of Engineers by an additional breakwater to the eastward of the entrance, also providing the west breakwater with a parapet. Estimated cost, \$500,000, '85, 2235; '87, 2317, 2319.

Surveys.

Of channel between piers, 1881, '81, 2311.

Examination, 1885, of condition of superstructure of breakwater, '86, 1864.

MAPS.

'81, 2310; '82, 2400.

CLINCH RIVER, TENN. AND VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 145.)

Appropriations.

1880.....	\$10,000, '80, 1680.
1881.....	3,000, '81, 1864.
1882.....	3,000, '82, 1851.
1884.....	5,000, '84, 1651.
1886.....	5,000, '86, 1522.

Total 26,000

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '87, 1757.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 187, 190; '81, 253, 258; '82, 246; '83, 254; '84, 255; '85, 277; '86, 268; '87, 233.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1880-'86. Reports, '80, 1680; '81, 1862, 1864; '82, 1850; '83, 1495; '84, 1651; '85, 1766.

Lieut. Col. J. W. Barlow, 1886-'— Reports, '86, 1521; '87, 1755.

ASSISTANT.

E. C. Tollinger. Report, '81, 1665.

Operations.

All work done by hired labor.

1879-'80. No operations.

1880-'81. 549 cubic yards rock excavated, 140 cubic yards rock placed in wing-dams, and 248 snags and trees removed, '81, 1863.

1881-'82. 2,556 cubic yards rock removed, 1,686 cubic yards dam built, and 586 snags removed, '82, 1850.

1882-'83. 1,816 cubic yards rock removed, 1,624 cubic yards gravel excavated, 1,526 cubic yards earth embankment, and 4,666 cubic yards of riprap dam built, '83, 1496.

1883-'84. 95 cubic yards rock and 700 cubic yards gravel removed, 106 cubic yards stone put in dams, '84, 1651.

1884-'85. 11,476 cubic yards rock, sand, and gravel excavated, 398 linear feet timber cribs and 3,812 cubic yards stone dams constructed, 233 trees and snags removed, '85, 1767.

1885-'86. No operations for lack of funds, '86, 1522.

1886-'87. No operations, '87, 1756.

Plans.

By Maj. King, 1881, for improvement from Nash's Ford to Haynes, by construction of wing-dams and removal of obstructions. Estimated cost, \$24,510, '81, 1867.

Projects.

By Maj. McFarland, 1876, for obtaining high-water channel of from 1½ to 2 feet from mouth to Watkins Ferry, a distance of 145 miles, by construction of wing-dams and removal of obstructions for 230 miles. Estimated cost, \$26,400, '76, 737; '80, 1680.

After an expenditure of \$21,000, the estimate was increased by Maj. King, 1885, to \$50,000, '85, 1767; '87, 1755, 1757.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. King, '81, 1864.

CLINTON HARBOR, CONN.—IMPROVEMENT OF.**Appropriations.**

1882..... \$3,000, '83, 512.

Commerce.

Commerce to be benefited by improvement, '82, 631.

Contracts.

D. V. Howell, for riprap dike construction, at \$1.41 per ton, '84, 644.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 97; '82, 97; '83, 88; '84, 94; '85, 83; '86, 83; '87, 46.

CLINTON HARBOR, CONN.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. J. W. Barlow, 1881-'83. Reports, '82, 630.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 511; '84, 643; '85, 643.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 634; '87, 596.

ASSISTANT.

H. N. Babcock. Report, '82, 630.

Operations.

1883-'84. 375 feet of riprap dike built, '84, 643.

1884-'87. No operations, '85, 644; '86, 635; '87, 596.

Projects.

By Maj. Barlow, 1883, for closing the breach by a riprap stone dike, and if the desired depth was not restored by the increased tidal flow, to dredge channels 100 feet wide and 6 feet deep at mean low water through the two shoals. Estimated cost of dike, \$3,000; of dike and dredging, \$10,000, '82, 630; '86, 634; '87, 596.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Maj. Barlow, '82, 630.

MAPS.

'83, 511; '86, 634.

CLINTON RIVER, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 145.)

Appropriations.

1882-'79	\$11,500
1881.....	8,000, '81, 2254.
1882.....	6,000, '82, 2338.
1886.....	6,000, '86, 1842.

Total	31,500
1888.....	10,000, act of August 11, 1888.

Contracts.

1881. Dupuis, Johnston & Co., for dredging, at \$5.40 per hour, '81, 2254.

1882. T. M. Hubbell, for dredging, at 20 cents per cubic yard, '83, 1882. Carlin, Stickney & Cram, for material and labor, '83, 1882.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 221; '81, 300; '82, 294; '83, 304; '84, 307; '85, 330, 332; '86, 325; '87, 293.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1880-'83. Reports, '80, 2062; '81, 2253; '82, 2337.

Lieut. Col. O. M. Poe, 1883-'— . Reports, '83, 1880; '84, 2074; '85, 2165, 2190, 2192; '86, 1842; '87, 2265.

ASSISTANT.

B. H. Muehle. Reports, '80, 2063; '85, 2193.

Operations.

1881-'82. 2,700 linear feet of channel 60 feet wide and 8 feet deep dredged, 38 piles driven, and 600 feet of mattress placed in bank protection, '82, 2337.

1882-'83. 800 linear feet brush mattress sunk; 23 pile-clusters driven; pile-crib constructed at terminus of line of piles; 3,275 brush bundles and 23 cords stone placed in pile-crib; 6,123 cubic yards sand dredged, '83, 1880, 1881.

1883-'86. No operations for lack of funds.

1886-'87. Appropriation held until authority to purchase the necessary right of way is granted, '87, 2266.

Projects.

By Maj. Poe, 1870, for dredging channel of entrance 100 feet wide, 2,700 feet long, and 8 feet deep. Estimated cost, \$5,000, '71, 180; '81, 300.

By Maj. Harwood, 1880, for improvement below Mount Clements by excavation of channel 100 feet wide by 8 feet deep and construction of pile revetments. Estimated cost, \$25,000, '80, 2063.

CLINTON RIVER, MICH.—Continued.**Projects—Continued.**

By Lieut. Col. O. M. Poe, 1885, for improvement of entrance by dredging 3,400 feet of channel 100 feet wide and 10 feet deep, and construction of 3,280 linear feet of pile revetment, and repairs to pile-crib. Estimated cost, \$32,928, '85, 2193, 2195; '86, 325.

Surveys.

Resurvey, 1890, ordered by act of March 3, 1879. Made under direction of Maj. Harwood, '80, 2062.

Survey, 1885, ordered by act of July 5, 1884. Made under direction of Lieut. Col. Poe, '85, 332.

MAPS.

'82, 2338.

CLUBFOOT RIVER, N. C. (See NEW BERN TO BEAUFORT, N. C., INLAND LINE OF NAVIGATION.)**COAL RIVER, W. VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 253.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '87, 1929.

ASSISTANT.

W. C. Reynolds. Report, '87, 1929.

Physical Characteristics.

Description of river, '87, 1929.

Plans.

Lieut. Col. Craighill, 1887, did not recommend the improvement on account of its cost and difficulty of maintenance, '87, 1932.

Surveys.

Examination ordered by act of October 4, 1886. Made, 1887, under direction of Lieut. Col. Craighill, '87, 1929.

COANJOK BAY, N. C.—IMPROVEMENT OF.

(See CURRITUCK SOUND, N. C.—IMPROVEMENT OF.)

COANJOK BAY, NORTH RIVER BAR, AND CURRITUCK SOUND, N. C. (See CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, N. C.)**COCHECO RIVER, N. H.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 146.)

Appropriations.

1836-78	\$95,000
1862	28,000, '82, 428.
1864	28,000, '84, 473.
1866	10,000, '86, 551.

Total

161,000

1868..... 9,000, act of August 11, 1868.

COCHECO RIVER, N. H.—Continued.**Commerce.**

Justification of improvement, '83, 429; '86, 550.

Contracts.

1883. Hamilton & Sawyer, for excavation of cut-off channel through Alley's Point, '83, 428.

1884. T. Symonds, for rock removal and dredging, '85, 475, 476.

1886. T. Symonds, for rock removal, at \$9.50 and \$4.50 per cubic yard, '87, 466, 467.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 66; '84, 72; '85, 59; '86, 59; '87, 20.

ENGINEERS IN CHARGE.

Col. C. E. Blunt, 1883-'86. Reports, '83, 426; '84, 471; '85, 474.

Maj. J. A. Smith, 1886-'— . Reports, '86, 548; '87, 466.

Operations.

1882-'83. 12,260 cubic yards removed from cut-off through Alley's Point, '83, 428.

1883-'84. 10,600 cubic yards of gravel and 135 tons of bowlders removed from cut-off at Alley's Point, completing the proposed work thereat, '84, 471.

1884-'85. 3,408 cubic yards of rock and hard-pau removed from channel above Clements' Wharf, '85, 475.

1885-'86. 829 cubic yards rock removed from channel, '86, 549.

1886-'87. No operations for lack of funds, '87, 466.

Projects.

In 1836-'37 \$10,000 was appropriated for the improvement of the Cochecho branch of the Piscataqua River.

The project of 1870 proposed the formation, by rock removal and dredging, of a channel 40 feet wide and 4 feet deep at mean low water through the Lower Narrows and up to the packet landing in Dover, '71, 857; '72, 939; '76, 1, 164.

This work was accomplished in 1879, under aggregate appropriations of \$95,000, '79, 261; '83, 427; '86, 549.

In 1882 the project was amended so as to provide for a cut-off channel through Alley's Point and widening to 60 feet and deepening to 5 feet the existing channels through Trickey's and Clements' Point shoals. Estimated cost, \$28,000, '83, 427.

This work having been accomplished in 1883, it was proposed in 1884-'85 to widen to 50 feet and deepen to 5 feet all parts of the channel with less dimensions from Clements' Point to the packet landing, at an estimated cost of \$47,000, '84, 471; '85, 475; '87, 466.

Surveys.**MAPS.**

Of Cochecho River in vicinity of Dover, '83, 474.

COCKPIT POINT, VA.—EXAMINATION FOR ICE-HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 153.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '85, 999.

Plans.

In 1884 S. T. Abert did not consider that the requirements for an ice-harbor were found at Cockpit Point, '85, 1000.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Mr. Abert, '85, 999.

CEUR D'ALENE LAKE AND RIVER, IDAHO—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 372.

ENGINEER IN CHARGE.

Maj. W. A. Jones. Report, '85, 2442.

CŒUR D'ALENE LAKE AND RIVER, IDAHO—Continued.**Plans.**

In 1884 Maj. Jones considered that Cœur d'Alene Lake and River, and also Saint Joseph's River, were worthy of improvement, and recommended \$3,000 therefor, '85, 2443. Improvement not recommended by the Chief of Engineers, '85, 372.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Jones, '85, 2442.

COHANSEY CREEK, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 147.)

Appropriations.

1873-'79	\$19,500
1880	4,500, '80, 592.
1881	7,000, '81, 790.
1882	5,000, '82, 773.

Total 36,000

Contracts.

1880. J. V. Patten, for dredging, at 25 cents per cubic yard, '80, 592.
 1881. J. V. Patten, for dredging, at 32 cents per cubic yard, '81, 791.
 1882. F. C. Somers, for dredging, at 57 cents per cubic yard, '83, 629.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 95; '81, 124, 129; '82, 122, 126; '83, 123; '84, 132; '85, 125; '86, 122; '87, 84.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1878-'82. Reports, '80, 590; '81, 789.
 Capt. W. Ludlow, 1882-'83. Report, '82, 773.
 Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 629.
 Maj. W. H. Heuer, 1884-'85. Report, '84, 831.
 Lieut. Col. H. M. Robert, 1885-'— . Reports, '85, 853; '86, 847; '87, 812.

ASSISTANT.

J. J. Lee. Report, '83, 629.

Operations.

1879-'80. 28,605 cubic yards material dredged, '80, 590.
 1880-'81. 10,788 cubic yards material dredged, '81, 789.
 1881-'87. No operations, '87, 812.

Physical Characteristics.

Obstacles to navigation, '81, 672.

Private and Corporate Work.

Delay of city authorities in lowering gas and water pipes at Broad Street Bridge to permit continuation of dredging, '81, 789.

Projects.

By Lieut. Col. J. D. Kurtz, 1872, for dredging channel 130 feet wide and 4 feet deep, from lower steam-boat landing to Broad Street Bridge, and 3 feet deep to Nail-Works Bridge. Estimated cost, \$30,000, '73, 889.
 Modified, 1879, by Col. Macomb, to make the channel 80 feet wide and from 5 to 7 feet deep, '79, 69, 415. Estimate increased to \$41,000, '80, 591.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under the direction of Col. Macomb, '81, 129.

COLD SPRINGS BAY, N. Y. (See LLOYD'S HARBOR, N. Y.)**COLDWATER RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 148.)

Appropriations.

1879	\$7,000
1880	4,000, '80, 1321.

COLDWATER RIVER, MISS.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 155; '81, 209; '82, 206; '83, 215; '84, 225; '85, 240.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1878-'83. Reports, '80, 1321; '81, 1413; '82, 1551.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1149; '84, 1336.

Capt. E. Bergland, 1885-'— . Report, '85, 1518.

ASSISTANTS.

J. Barry. Report, '80, 1321.

J. H. Burney. Report, '80, 1322.

Operations.

1879-'80. 2,777 trees cut and girdled, '80, 1321.

1880-'81. 3,553 logs, snags, and stumps removed and trees cut down, '81, 1413.

1881-'85. No operations from lack of funds; further appropriations not recommended.

Projects.

By Capt. Benyaard, 1879, for removal of obstructions by hired labor, and use of U. S. flat-boat. Estimated cost, \$25,000, '79, 116, 970, 985.

Surveys.

Examination of Coldwater and Tallahatchee rivers. Made, 1880, under direction of Maj. Benyaard, '80, 1322.

COLONIAL BEACH, WESTMORELAND COUNTY, VA.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 153.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '85, 1001, 1002, 1004.

Physical Characteristics.

Description of locality, '85, 1001, 1005.

Plans.

By S. T. Abert, 1885, for the formation of a dredged channel 300 feet wide and 16 feet deep and a turning basin 400 feet square. Estimated cost, \$20,800, '85, 1003, 1005. Not recommended by the Chief of Engineers, '85, 153.

Surveys.

Ordered by act of July 5, 1884. Made under the direction of S. T. Abert, '85, 1001, 1002.

COLORADO RIVER, CAL., NEV., AND ARIZ.—IMPROVEMENT OF.

(Continued from Vol. I, p. 149.)

Appropriations.

1884..... \$25,000, '85, 2367.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 363; '86, 356; '87, 324.

ENGINEER IN CHARGE.

Capt. A. H. Payson, 1884-'87. Reports, '85, 2365; '86, 1929; '87, 2449.

ASSISTANT.

Lieut. S. W. Roessler. Report, '85, 2367.

Operations.

1884-'85. 1,074 tons stone removed from river-bed; 614 linear feet of cobble-dam built, '85, 2367.

1885-'86. 2,688 linear feet of cobble-dam built; top of Explorer's Rock blasted off; 1,240 tons rock removed, '86, 1931.

1886-'87. Property and supplies sold at auction and proceeds turned into Treasury, '87, 2449.

COLORADO RIVER, CAL., NEV., AND ARIZ.—Continued.**Projects.**

By Capt. Payson, 1879, for improvement of the river by removal of obstructions, protection of banks, and construction of the channel. Estimated cost, \$97,269, 79, 1780.

In 1886 it was considered that any noteworthy improvement would be at an enormous cost and not required by commerce, '86, 1932; '87, 2449.

Surveys.**MAPS.**

'85, 2368.

COLUMBIA RIVER (UPPER) AND SNAKE RIVER, OREG. AND WASH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 150.)

Appropriations.

1872-'79	\$160,000
1880	15,000, '80, 2292.
1881	15,000, '81, 2562.
1882	6,000, '82, 2663.
1884	20,000, '84, 2231.
1886	10,000, '86, 1950.

Total 226,000

1888 10,000, act of August 11, 1888.

List of appropriations, '86, 1950.

Commerce.

Navigation on Upper Columbia, '85, 2445, 2448.

Contracts.

1880. G. J. Ainsworth, for rock removal, at \$18 per cubic yard, '80, 2293. J. B. Montgomery, for rock removal, at \$17 and \$25 per cubic yard, '81, 2563.

1883. F. T. Dodge, for rock removal at \$12, and gravel at \$2 per cubic yard '83, 2042.

1884. J. Kelley & Co., wing-dam construction, '85, 2438.

Holmes & Spencer, rock removal, and J. R. Smith, rock removal, '83, 2438.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 238; '81, 236; '82, 320; '83, 333; '84, 337; '85, 370; '86, 359, 360; '87, 332.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1878-'81. Reports, '80, 2289; '81, 2558.

Capt. C. F. Powell, 1881-'84. Reports, '82, 2660; '83, 2040; '84, 2229.

Maj. W. A. Jones, 1884-'—. Reports, '85, 2437, 2445, 2452; '86, 1949, 1953, 1970; '87, 2520.

ASSISTANTS.

P. C. Eastwick. Report, '84, 2232.

Lieut. T. Symons. Report, '85, 2445.

Lieut. W. Young. Report, '86, 1951.

E. T. Voigt. Report, '86, 1955.

Operations.

History of operations previous to 1880, '80, 2294.

1879-'80. Removal of rock from Monumental, Homly, and Umatilla rapids, '80, 2290, 2297.

1880-'81. Removal of rock from Monumental and Texas rapids, '81, 2558, 2560.

1881-'82. Removal of rock from Texas, Palouse, and False Palouse rapids, '82, 2680.

1882-'83. No operations, '83, 2040.

1883-'84. Rock removal at Five-Mile Rapids, '84, 2230.

1884-'85. Rock removal at White's Ferry, Jim Ford's Island, and Fish-Hook Rapids, '85, 2437.

1885-'86. 645 cubic yards rock and gravel removed from rapids, '86, 1949.

1886-'87. Construction of drilling-scow and rock removal by hired labor at Texas and Little Goose rapids; construction of sheer-crib on Log Cabin Rapids; survey of rapids, '87, 2521, 2522.

Physical Characteristics.

Description of rivers, '80, 2393; '84, 2234.

Elevation of water surface of Upper Columbia, '86, 1958.

Current observations on Upper Columbia, '86, 1959; '87, 2521.

COLUMBIA RIVER (UPPER) AND SNAKE RIVER, OREG. AND WASH.—Continued.

Plans.

By Maj. Jones, 1885, for the improvement of Priest Rapids, on the Columbia River above Snake, by the removal of rock. Estimated cost, \$153,240, '86, 1965.

Projects.

Previous to the adoption of the project of 1877 efforts were directed to the removal of rocks at rapids on the Upper Columbia below the mouth of Snake River, '77, 1044; '80, 2234.

The project of 1877 proposed the removal of rock at rapids so as to give channel depths of 5½ feet on the Columbia and 4½ feet on the Snake River between Celilo on the former and Lewiston on the latter, a distance of 266 miles. Estimated cost, \$132,000, '77, 1045; '82, 2040; '86, 359; '87, 2520.

Surveys.

Of Snake River below Lewiston, '84, 2230, 2232.

Of Snake River above Lewiston, '82, 2716.

Of Columbia River above mouth of Snake, '85, 2445; '86, 1963.

MAPS.

Of Monumental Rapids, '80, 2296.

Of Palouse Rapids, '81, 2562; '82, 2662.

Of Texas Rapids, '81, 2562.

Of False Palouse Rapids, '82, 2662.

Of 1st, 2d, 3d, 4th, 5th, 6th, and 7th rapids, "

Cabinet Rapids, '86, 1966.

Yakima Region, '86, 1966.

COLUMBIA RIVER, OREG.—IMPROVEMENT OF THE CASCADES.

(Continued from Vol. I, p. 152.)

Appropriations.

1876-79	\$340,000
1880	100,000, '80, 2301.
1881	100,000, '81, 2567.
1882	265,000, '82, 2667.
1884	150,000, '84, 2448.
1886	187,500, '86, 1945.

Total 1,142,500

1888 300,000, act of August 11, 1888.

Statement of appropriations, '82, 2667; '84, 2248; '85, 2430; '86, 1495.

Commerce.

Uncertainty of the benefits of the improvement, '80, 2301.

Advantages of the improvement, '81, 2566; '82, 2668; '83, 2044.

Draught of vessels passing the Cascades, '80, 2312.

Character of present navigation, '81, 2577; '82, 2673.

Dimensions of vessels on river, '81, 2580.

Cost of transportation, '86, 1492, 1494.

Contracts.

1880. Ball & Platt, for canal construction, '80, 2302. Contract abrogated, '80, 2399.

1882. Chalmers & Holmes, for the removal of submerged rock, \$25, and exposed rock, \$3 per cubic yard, '82, 2668. Failure of contract system, '83, 2043.

1886. Portland Construction Company, for wharf at canal, '87, 2480.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 239; '81, 327, 2570; '82, 321; '83, 334; '84, 337; '85, 370; '86, 358; '87, 328.

BOARD OF ENGINEERS.

Convened August, 1879, to consider questions to be submitted by engineer officer in charge, '80, 2298, 2305. Report, '80, 2305.

(Lient. Cols. Stewart and Mendell and Maj. Gillespie.) Re-convened November, 1880. Report, '81, 2572.

(Lient. Cols. Stewart, Williamson, and Mendell, Maja. Weitzel, Houston, and Gillespie.)

COLUMBIA RIVER, OREG.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. G. L. Gillespie, 1878-'81. Reports, '80, 2298, 2309, 2311; '81, 2563.

Capt. C. F. Powell, 1881-'84. Reports, '82, 2664; '83, 2043; '84, 2246.

Maj. W. A. Jones, 1884-'86. Reports, '85, 2426; '86, 1924.

Capt. C. F. Powell, 1886-'— . Report, '87, 2476.

ASSISTANTS.

Lieut. C. F. Powell. Reports, '80, 2302, 2310; '86, 2567.

Lieut. C. F. Powell. Reports, '82, 2669; '83, 2047.

Lieut. W. Young. Reports, '84, 2249; '85, 2430; '86, 1945; '87, 2481.

Operations.

1879-'80. By contract 28,944 cubic yards earth, 12,102 cubic yards of loose and 26,640 cubic yards of solid rock removed from canal prism, 186,292 pounds iron pipe, and 1,398 cubic yards of masonry stone delivered. By hired labor, 35,080 cubic yards material excavated and 273 cubic yards masonry laid, '80, 2300, 2305.

1880-'81. Progress on excavation of canal prism by hired labor, '81, 2568.

1881-'82. Progress on canal construction by hired labor, '82, 2664, 2669; 4,527 cubic yards boulders removed from area adjacent to canal by contract, and 8,348 cubic yards by hired labor, '82, 2665, 2671. Drilling and blasting by hired labor, '82, 2666; cost of rock removal by surface blasting, '82, 2672.

1882-'83. Progress on canal construction by hired labor, '83, 2043, 2048. Borings to determine site of lock, '83, 2044. Rock removal in river below site of canal, '83, 2045, 2051. Cost of rock removal, '83, 2051.

1883-'84. Progress on canal construction, '84, 2246, 2249. Rock removal in river, '84, 2246, 2251. Records of rock removal, '84, 2247, 2251, 2253. Cost of rock removal, '84, 2252.

1884-'85. Progress on canal construction, '85, 2429, 2431. Rock removal in river, '85, 2434. Cost and details of rock removal, '85, 2435.

1885-'86. Progress on canal construction, '86, 1945.

1886-'87. 58,000 cubic yards of rock removed at lock-site; stone-cutting, quarrying, and canal-paving in progress, '87, 2482. Cost of rock removal, '87, 2482.

Physical Characteristics.

Current velocities at Cascades, '80, 2306.

Movement of earth of rocky slopes about the Cascades, '80, 2313.

High-water stages, '81, 2569; '85, 2429.

Rain-fall records, '83, 2048; '84, 2251; '85, 2438; '86, 1947; '87, 2485.

Drainage areas of river, '85, 2426.

Fall of river at Cascades, '85, 2428.

Projects.

The project of 1877 proposed the improvement of the Cascades by a canal on the Oregon side about 7,200 feet long, with 2 locks 300 feet long, 50 feet wide, having a low-water depth of 8 feet over the miter-sills. Estimated cost, \$1,544,545, '77, 1047; '78, 1033.

In 1878 the width of the locks was increased to 70 feet, '78, 1336, and the estimated cost of the work to \$1,753,867, '78, 1337; '80, 2301. Dimensions of canal, '79, 1849.

The Board of Engineers of 1879 recommended the improvement of the low-water navigation through the reefs below the canal before the commencement of the construction of the lock masonry, '80, 2307, 2314; '81, 2571.

In 1880 the project was modified by the Board of Engineers to provide for a navigation from low water to a stage 20 feet above; the construction of a single lock near the foot of the rapids 462 feet long, 90 feet wide, and with a lift of 24 feet, the gates to be 70 feet wide; canal prism about 3,000 feet long, 90 feet wide at bottom, and 8 feet deep, '81, 327, 2564, 2576.

In 1882, to provide for modifications of project and improvement of channel below canal, a revision of estimates was made, '81, 321.

Amount appropriated from 1876 to 1882..... \$805,000.00 }

Amount required to complete project 1,655,397.31 } '82, 2667.

Total..... 2,460,397.31, '83, 2043.

In 1885 it was proposed to make the widths of the gates equal to width of lock, '85, 2429.

Increased width of 90 feet approved by Board of Engineers in 1886, '86, 1945.

Total amount appropriated to 1886, \$1,142,500, '86, 1945.

Amount required to complete project, \$1,100,000, '86, 359.

In 1887 a revision of the estimates made the total estimated cost of the work \$2,992,500, '87, 2477, 2480.

COLUMBIA RIVER, OREG.—Continued.**Surveys.**

1879-'80, of Cascades, '81, 2563.

Maps.

Of Cascades, '83, 2046; '84, 2246, 2252; '85, 2434.

Of general river, '85, 2426.

COLUMBIA RIVER AT THE DALLES, OREG.—SURVEY OF.**Commerce.**

Present navigation through the Dalles, '82, 2695, 2696.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 242; '81, 332.

ENGINEER IN CHARGE.

Capt. C. W. Powell. Report, '82, 2690.

Physical Characteristics.

Description of the Dalles, '82, 2692, 2695.

Gauge-readings, '82, 2702.

River slope, '82, 2693.

Current velocities, '82, 2704.

Plans.

By Capt. Powell, 1882:

(1) To carry the Celilo level by a canal with a lock at upper end to a flight of locks near Gauge Station No. 4, '82, 2697.

(2) With lift-locks, as in (1), to dam the river, making the overfall into Big Eddy, '82, 2697.

(3) Open river improvement for all stages to Celilo Falls and lockage at the falls, '82, 2697.

(4) Open river improvement for lower stages to Celilo Falls; lockage from low to mean high water at falls; open passage over falls for higher stages and lockage at the Dalles Rapids, '82, 2697.

Estimates, low-water project (1), (2), (3), \$7,674,495; estimates, high-water project (1), (2), \$2,842,848, '82, 2699, 2711.

Surveys.

Ordered by act of March 3, 1879, '80, 242. Made, 1880, under direction of Maj. Gillespie and Capt. Powell, '82, 2690.

COLUMBIA RIVER (LOWER), OREG. (Willamette and Columbia rivers below Portland, except Columbia River at its mouth).

(Continued from Vol. I, p. 587.)

Appropriations.

1866-79	\$315,365
1880, Lower Willamette and Columbia rivers	45,000, '80, 2258.
1881, Lower Willamette and Columbia rivers	45,000, '81, 2538.
1882, Lower Willamette and Columbia rivers	100,000, '82, 2652.
1884, Lower Willamette and Columbia rivers	100,000, '84, 2220.
1886, Lower Willamette and Columbia rivers	75,000, '86, 1939.
Total	680,365
1888	100,000, act of August 11, 1888.
1882, gauging Lower Columbia and its tributaries....	500, '83, 2076.
1884, gauging Lower Columbia and its tributaries....	1,000, '84, 2292.
1886, gauging Lower Columbia and its tributaries....	1,000, '86, 2010.
1888, gauging Lower Columbia and its tributaries....	2,500, act of August 11, 1888.

List of appropriations from 1866 to 1886, '86, 1939.

Commerce.

List of vessels navigating the river, '80, 2273; '83, 2009.

Contracts.

1879. R. Watson, for hire of steam-tug, '80, 2260. Pacquit & Smith, for construction of pile-dike near Swan Island, '80, 2259. Pacquit & Smith, for construction of pile-dam across Willamette Slough, '80, 2259.

1880. Holmes & Sweeney, for construction of pile-dike, '81, 2538.

COLUMBIA RIVER (LOWER), OREG.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 237; '81, 324; '82, 318; '83, 331, 337; '84, 334, 341; '85, 364, 368; '86, 357, 365; '87, 331.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1878-'81. Reports, '80, 2253; '81, 2531.

Capt. C. F. Powell, 1881-'86. Reports, '82, 2643; '83, 1997, 2076; '84, 2215, 2290; '85, 2376, 2408.

Maj. W. A. Jones, 1886-'—. Reports, '86, 1938, 2010; '87, 2507.

ASSISTANTS.

R. A. Habersham. Reports, '80, 2260; '81, 2541; '83, 2005.

Lieut. P. M. Price. Reports, '81, 2558; '82, 2653.

J. S. Polhemus. Report, '84, 2292.

Operations.

History of previous operations, '80, 2266.

1879-'80. Construction of pile, facine, and stone dam across Willamette Slough, '80, 2254, 2261. Shore protection and construction of dike at Coon Island, '80, 2254, 2263. 20,795 cubic yards dredged from mouth of the Willamette, Saint Helen's, and Swan Island bars, '80, 2255, 2260.

1880-'81. Partial completion of pile-dike closing Coon Slough; revetment of right bank of Willamette Slough; 14,550 cubic yards dredged from Swan Island and Willamette bars, '81, 2532, 2533, 2544.

1881-'82. Completion of Coon Slough Dike; repairs to Willamette Slough Dam; 7,335 cubic yards dredged from Saint Helen's and Swan Island bars, '82, 2644, 2646. Construction of a new dredge, '82, 2648.

1882-'83. Deepening of channel over Saint Helen's Bar by private enterprise, '83, 1998. 47,650 cubic yards dredged from Swan Island Bar by United States dredge, '83, 2000. 12,812 linear feet of revetment and dams built between Portland and mouth of river, '83, 2001, 2005. Gauging lower river, '83, 2076.

1883-'84. Deepening channel of Saint Helen's Bar by private enterprise, '84, 2217. 29,445 cubic yards removed by United States dredge from Swan Island Bar, '84, 2218. Maintenance of structures and removal of snags, '84, 2,218. Gauging Columbia River and principal tributaries, '84, 2290.

1884-'85. Sluicing on Saint Helen's Bar by steamship Walla Walla, '85, 2377, 2380. 54,161 cubic yards dredged, Upper Bar, by United States dredges, '85, 2377, 2379. Construction and repair of dikes and shore protection, '85, 2378. Gauging operations continued, '85, 2408.

1885-'86. Repairs to dike at Saint Helen's; Willow planting on Sauvie's Island; repairs to tug Lincoln, '86, 1938. Gauging operations continued, '86, 2010.

1886-'87. Repairs to dike at Saint Helen's Bar and 1,112 linear feet of dike extension; propeller dredging on Saint Helen's Bar; removal of snags, '87, 2505, 2510.

Physical Characteristics.

Description of river, '80, 2266.

Stages of water at Portland, '80, 2265; '81, 2542; '82, 2651.

Gauging lower river and principal tributaries, '83, 2076; '84, 2290; '85, 2408; '86, 2010.

Private and Corporate Work.

Operations by city of Portland to improve the river previous to 1866, '80, 2266. \$7,442 furnished by city of Portland in 1882 for continuance of work, '82, 2651.

Construction of a dredge by city of Portland in 1883, '83, 331.

Expenditure of \$10,000 by private enterprise for improvement of Saint Helen's Bar, '83, 331; continued in 1884, '84, 2217; continued in 1885, '86, 1939.

Establishment of Portland Harbor lines, '83, 2003.

Projects.

History of operations and projects prior to 1880, '80, 2266.

From 1866, the date of the first appropriation, to 1876, the improvement consisted in dredging across Swan Island, Post-Office, and Saint Helen's bars, and the bar at the mouth of the Willamette River, '80, 2267, 2270.

In 1877 a Board of Engineers recommended the permanent improvement of the channel from Portland, on the Willamette, to Columbia City, on the Columbia, so as to permit the passage of vessels drawing 20 feet or more. Improvements at the following localities: A dike closing the south channel of Willamette at Swan Island; the partial closing of Willamette Slough; dikes and revetment at the mouth of the Willamette to confine the current to the principal channel; the construction of converging dikes on Saint Helen's Bar.

The amount appropriated previous to 1877 was \$240,365, '77, 1004. The Board estimated the cost of the above-named works at \$298,974, '77, 1019-1025; '80, 2270.

COLUMBIA RIVER (LOWER), OREG.—Continued.**Projects—Continued.**

- In 1879 a Board of Engineers recommended the substitution of constructions made of piles, fascines, and stone in place of the brush and stone previously recommended, '80, 2253.
- In 1882 \$265,000 had been appropriated under this project, when it was modified to cover increased cost of work and additional constructions required, at an estimated cost of \$183,635, '82, 2644; '83, 1998; '84, 2216.
- In 1885 \$365,000 had been appropriated under the projects of 1877-'82, when it was further modified to cover the improvement of three shoal areas below Columbia City. Amount estimated for completion of project in 1885 was \$407,000, '85, 2377; '86, 357, 1940.
- In 1887 the estimated cost of completion was increased \$68,000, '87, 2516.

Surveys.**MAPS.**

'80, 2272; '83, 2008; '85, 2378.

COLUMBIA RIVER, OREG.—IMPROVEMENT AT MOUTH OF.

(Continued from Vol. I, p. 587.)

Appropriations.

1878-'80	\$10, 000
1882	7, 500, '83, 2010.
1884	100, 000, '84, 2224.
1886	187, 500, '86, 1976.

Total 305, 000

1898 500, 000, act of August 11, 1898.

Commerce.

Commerce to be benefited, '81, 2537; '83, 2011, 2031; '84, 2225; '86, 1974, 1983; '87, 2473, 2474. Delay due to present condition of bar, '84, 2223.

Draught of vessels entering river, '84, 2223.

Contracts.

1885. L. W. Holt, for construction of wharf and trestle at Point Adams, '85, 2385.
J. F. Steffen, for construction of 4 stone barges, '85, 2385. P. F. Falbert, for delivery of piles, '85, 2387. L. Michael, for delivery of riprap stone, '85, 2387.
1886. Oregon Paving Company, for furnishing piles and stone, '87, 2474.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 240; '83, 332, 2011; '84, 335; '85, 364; '86, 360; '87, 327.

BOARD OF ENGINEERS.

Convened at New York February 12, 1881, to consider the improvement of the mouth of the Columbia River. The Board did not consider it necessary at that time to submit any plan for improvement, '81, 2548, 2552. (Cols. Tower and Newton and Lieut. Col. Abbot.)

Board constituted by S. O. No. 82, C. of E., 1882, to report upon a plan for the permanent improvement of the mouth of the river. Report, '83, 2012. (See also PROJECTS.) (Lieut. Cols. Stewart, Craighill, Comstock, and Mendell and Capt. Powell.)

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1878-'81. Reports, '80, 2315, 2318; '81, 2534, 2536.

Capt. C. F. Powell, 1881-'— . Reports, '82, 2647; '83, 2010; '84, 2222; '85, 2382; '86, 1972; '87, 2470.

ASSISTANTS.

E. A. Habersham. Report, '80, 2317.

G. M. Jessen. Report, '80, 2321.

Lieut. E. Burr. Report, '86, 1976.

P. W. Eastwick. Report, '86, 1980.

Operations.

1879-'80. Survey of mouth and efforts to increase channel depth of Sand Island Shoal, by scraping, '80, 2315.

1880-'81. Survey of mouth continued; efforts to increase depth over bar by harrowing, '81, 2534, 2547.

1881-'84. Continuation of surveys and studies for plans of improvement, '84, 2222.

1884-'85. Construction and purchase of plant and commencement of work by hired labor on tramway for construction of jetty, '85, 2383.

COLUMBIA RIVER, OREG.—Continued.**Operations—Continued.**

1885-'86. 1,944 cubic yards brush mattresses and 3,346 cubic yards of stone placed in the jetty; 1,080 linear feet of jetty tramway built, '86, 1973. Methods of construction, '86, 1981.

1886-'87. Difficulties of stone transportation; construction of tramway in progress, '87, 2471; 2472.

Physical Characteristics.

Description of mouth, '83, 2012.

Movement of shore-lines, '80, 2316, 2317, 2318; '81, 2540; '83, 2021; '86, 1978, 1980.

Low water cross-section at mouth, '83, 2012.

Stages of water on the bar, '81, 2542; '86, 1979.

Description of ocean bed, '83, 2026; '86, 1978.

Tidal velocities, '83, 2013.

Tidal data, '83, 2027.

Tidal prism, '83, 2013.

Force and direction of wind, '83, 2028.

Plans.

By Maj. Gillespie, 1879, for a dike about 10,000 feet long, of large rubble-stone extending from the inside of Point Adams along the east edge of Clatsop Spit to the 4-fathom curve in the south channel, the dike to rise about 3 feet above low water and to have a top width of 25 feet. Estimated cost, \$4,750,000, '80, 2320; '81, 2546.

In 1880 Maj. Gillespie proposed a pile-dike about 8,000 feet long, filled with fascines and stone, starting at the northeast corner of Fort Stevens and following the 12-foot curve around Clatsop Spit. Estimated cost, \$430,000, '81, 2547, 2548. Plan not approved by Board of Engineers of 1881, '81, 2535, 2552. Board do not consider it necessary at this time to submit any plan for improvement, '81, 2552.

Projects.

By Board of Engineers, 1882, for a jetty slightly convex to the north, extending from the shore near Fort Stevens in a northwesterly direction towards a point about 3 miles south of Cape Disappointment, jetty to consist of random stone placed on a mattress foundation, and to be about 24,000 feet in length, with its top at low water, and a width not less than 5 feet, the outer 7,500 feet of the jetty to be faced with beton blocks of from 5 to 20 cubic yards each. Estimated cost, \$3,710,000, '83, 2018; '87, 2470. Lieut. Col. Meadell, differing on some points from the majority of the Board, submits a minority report, '83, 2034. Congress authorizes commencement of improvements recommended by majority of Board, '84, 402.

Surveys.

Ordered by act of March 3, 1879, '80, 2315. Made under direction of Maj. Gillespie, 1879, '80, 2315, 2318, 2319; continued, '81, 2538, 2550; '86, 1976.

Comparison of various surveys, '81, 2549; '83, 2014, 2021.

Gauging discharge, '86, 2010.

Amplitude of tides, '81, 2550.

Maps.

'81, 2546, 2552; '86, 1978, 1980.

COLUMBIA RIVER—ESTABLISHMENTS OF GAUGES ON.

(See COLUMBIA RIVER, LOWER.)

COMPTON'S CREEK, N. J. (See SHOAL HARBOR, N. J.)**CONECUH RIVER, ALA. AND FLA. (See ESCAMBIA RIVER, ALA. AND FLA.)**

CONGAREE RIVER, S. C.—SURVEY AND IMPROVEMENT OF.**Appropriations.**

1886..... \$7,500, '87, 1095.
 1888..... 7,500, act of August 11, 1888.

Commerce.

Justification of the improvement, '85, 1140, 1142; '87, 1093, 1096.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 177; '87, 138.

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '85, 1140, 1143.

ASSISTANTS.

R. Whitford. Reports, '85, 1140; '87, 1095.

S. McBea. Report, '85, 1144.

Physical Characteristics.

Description of river, '85, 1140, 1144.

Operations.

1886-'87. Partial removal of obstructions from the river between mouth and Grandby so as to give a 3-foot depth at low water, '87, 1094, 1095.

Projects.

By Capt. Bixby, 1884, to secure a 4-foot navigation from its mouth to Grandby Landing, a distance of 47 miles, by the removal of snags, logs, rocks, and slight shoals, and in properly protecting caving banks. Estimated cost, \$30,000, '85, 1144.

In 1887 the project was modified by providing for the clearing of obstructions to natural depth of the river above Grandby at a total estimated cost of \$54,500, '87, 1093.

Surveys.

Ordered by act of July 5, 1884. Made under the direction of Capt. Bixby, 1885, '85, 1140, 1143.

MAPS.

'87, 1094.

CONNEAUT HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 153.)

Appropriations.

1829-'79 \$106,629.39
 1880 6,000.00, '80, 2172.

Statement of annual appropriations, with method of expenditure, '83, 1922.

Contracts.

1881. J. W. Dennis, for pile construction, '81, 2329.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 228; '81, 312; '82, 307; '83, 315; '84, 319; '85, 343; '86, 338; '87, 303.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2166; '81, 2328; '82, 2412.

Capt. M. B. Adams, 1883-'84. Report, '83, 1920.

Capt. E. Maguire, 1884-'85. Report, '84, 2118.

Maj. L. C. Overman, 1885-'—-. Reports, '85, 2245; '86, 1873; '87, 2332.

Operations.

History of work, '80, 2166.

1879-'81. No operations from lack of funds, '81, 2328.

1881-'82. 473 linear feet pile protection finished, '82, 2412.

1882-'87. No operations, '86, 1873; '87, 2332.

History of operations, '87, 2332.

Projects.

By Capt. Maurice, 1829, for closing existing channel by a dam and driving a straight channel through sand-bar at mouth of river by means of parallel piers of crib-work. Estimated cost, \$20,001.65, '80, 2166. Project completed in 1835, '80, 2167.

By Col. Cram, 1886, for repair of existing pier-work, prolongation of west pier 350 feet, and dredging channel 115 feet wide and 12 feet deep. Estimated cost, \$31,112, '80, 2169. Project completed in 1872, '80, 2170.

CONNEAUT HARBOR, OHIO—Continued.**Projects—Continued.**

By Maj. J. M. Wilson, 1880, for restoration of pier and construction of pile-work.
Estimated cost, \$35,090, '80, 2171; '86, 1873; '87, 2332.

Surveys.

Examination made in 1879, '80, 2170.

MAPS.

'81, 2330.

CONNECTICUT RIVER, ABOVE HARTFORD, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 156.)

Appropriations.

1829-79 \$85,000
1880 15,000, '80, 396.

Contracts.

Hartford and New York Transportation Company, for building wing-dams, at \$1.85 per cubic yard, '80, 396.

1886. C. G. Goodrich, for repair of dikes, '87, 589.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 75; '81, 86; '82, 87; '83, 87; '84, 93; '85, 80; '86, 81; '87, 44.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1870-'83. Reports, '80, 394; '81, 565, 566; '82, 564.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 507; '84, 639; '85, 632.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 623; '87, 587.

ASSISTANT.

T. G. Ellis. Report, '81, 568.

Operations.

1880-'81. 820 linear feet of upper dam and 643 linear feet of lower dam finished, '81, 565.

1881-'82. 180 linear feet of upper dam and 185 linear feet of lower dam completed, '82, 564.

1882-'84. No operations, '83, 507; '84, 639.

1881-'85. 1,629 cubic yards stone placed in dike, '85, 633.

1885-'86. No operations, '86, 625.

1886-'87. Repair of wing-dams at mouth of Farmington River and at Barber's Landing, '87, 588.

Physical Characteristics.

Description of river, '81, 569.

Plans.

By Lieut. Col. G. K. Warren, 1880, for canal around Enfield Falls, on east bank of river, extending down to mouth of Hockannon River, opposite Hartford. Estimated cost, \$1,322,805, '81, 566; '87, 588.

Projects.

By Maj. Warren, 1871, for giving an increased depth to the channel by the construction of wing-dams at five places between Hartford and Enfield Rapids, and by dredging. Estimated cost, \$350,000, '71, 84, 757. No general project adopted, '87, 588.

Surveys.

Of Farmington River Bar, 1879, to ascertain condition of channel, '80, 394.

CONNECTICUT RIVER, BELOW HARTFORD, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 156.)

Appropriations.

1829-79 \$235,130
1880 10,000, '80, 398.
1881 30,000, '81, 578.

CONNECTICUT RIVER, BELOW HARTFORD, CONN.—Cont'd.**Appropriations—Continued.**

1882.....	\$45,000, '82, 566.
1884.....	35,000, '84, 642.
1886.....	26,250, '86, 629.

Total 381,380

1888..... 10,000, act of August 11, 1888.

List of appropriations from 1867 to 1880, '84, 642.

Commerce.

Statement of business influenced by proposed improvement, '80, 399.

Contracts.

1879. Hartford and New York Steamboat Company, for dredging, at 16½ cents per cubic yard, '80, 397.

1880. J. Beattie, for riprap granite, at \$1.05 cents per ton, '81, 575. McDermott & Daly, for dredging, at 15½ cents per cubic yard, '81, 575.

1881. E. H. Williams, for dredging, at 13 cents per cubic yard, '81, 576. E. H. Williams, for wing-dam construction, at \$1.60 cents per cubic yard, '81, 577. E. H. Williams, for riprap granite, at \$1.29 per ton, '81, 577. J. McDermott, for dredging, at 14½ cents per cubic yard, '82, 565.

1884. H. N. & A. J. Beardsley, for dredging, at 15 cents per cubic yard, '85, 636. J. Beattie, for jetty construction, at \$1.16 per ton of stone, '85, 636.

1886. C. H. Edwards, for dike construction at Hartford, '87, 595. J. V. Luce, for dike construction at Saybrook, '87, 595.

1887. Pidgeon Dredging Company, for dredging, at 11½ cents per cubic yard, '87, 595.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 76; '81, 88; '82, 88; '83, 87; '84, 93; '85, 80; '86, 82; '87, 45.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1870-'83. Reports, '80, 396, 398; '81, 575; '82, 564.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 508; '84, 640; '85, 633.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 625; '87, 590.

ASSISTANT.

T. G. Ellis. Report, '80, 400.

Operations.

Previous operations, '80, 412.

1879-'80. 8,136 tons stone placed in 765 linear feet of jetty, 34,692 cubic yards of material dredged, '80, 397.

1880-'81. 26,062 cubic yards material dredged, 6,184 tons stone placed in east jetty, '81, 576.

1881-'82. 9,017 cubic yards material dredged, 7,109 cubic yards stone placed in dam, 4,984 tons granite placed in jetties, '82, 565, 566.

1882-'83. 31,117 cubic yards material dredged, 10,307 tons stone placed in wing-dam, '83, 509.

1883-'84. 61,342 cubic yards of material dredged, '84, 641.

1884-'85. 148,366 cubic yards material dredged, 8,840 tons stone placed in jetty extension, '85, 636.

1885-'86. 1,582 tons stone placed in jetty extension, 24,054 cubic yards material dredged, '86, 627, 628.

1886-'87. 51,261 cubic yards dredged from shore areas, 2,346 tons stone placed in Hartford Dike, 6,829 tons of stone placed in Saybrook jetties, '87, 592.

History of past operations, '87, 594.

Physical Characteristics.

Description of river, '80, 401.

Discharge and height of Connecticut River at Hartford, 1878, '80, 408.

Height of freshets above low water, '80, 403. Slope of river, '80, 411.

Table of borings between Hartford and Rocky Hill, '80, 420.

Projects.

The project of 1863 proposed the formation, by dredging, of channels 8 feet deep at low water and 100 feet wide at Hartford, Clay Banks, Pratt's Ferry, Glastonbury, and Pistol Point, and a channel 200 feet wide and 8½ feet deep at Saybrook Bar; shore protection at Hartford and Weathersfield, and the removal of Chester Rock, '68, 66, 750, 776; '69, 409; '70, 447; '87, 591.

In 1873 jetties were proposed for the improvement of Saybrook Bar, with dredging to form a channel 9 feet deep and 400 feet wide, '73, 985; '87, 591.

CONNECTICUT RIVER, BELOW HARTFORD, CONN.—Cont'd**Projects—Continued.**

By Lieut. Col. Warren, 1879, for the formation of a channel 200 feet wide and 6 feet deep between Hartford and Long Island Sound by mattress protection of banks; rectification of banks at Clay Banks and Glastonbury Bar; construction of wing-dams at Hartford Bar, Pratt's Ferry Bar, Press Barn Bar, Glastonbury Bar, and Dividend Bar. Estimated cost, \$330,000, '80, 417, 418, 419, 420.

Surveys.

Examination of channel, 1880, '80, 397.

Survey between Hartford and Rocky Hill. Made, 1879, under direction of Lieut. Col. Warren, '80, 398.

MAPS.

'83, 510; '85, 636.

CONNECTICUT RIVER—EXAMINATION OF, FROM BELLOWS FALLS, VT., TO PLATTSBURGH, N. H.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 99.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '84, 659.

Physical Characteristics.

River described, '84, 659.

Plans.

In 1882 Maj. Barlow considered that the improvement of the upper river was one not worthy to be made by United States, and that the work was not a public necessity, '84, 659.

CONTENTNEA CREEK, N. C.—SURVEY AND IMPROVEMENT OF.**Appropriations.**

1881.....	\$10,000, '81, 1010.
1882.....	10,000, '82, 1092.
1884.....	5,000, '84, 1042.
1886.....	15,000, '86, 975.

Total.....	40,000
------------	--------

1888.....	5,000, act of August 11, 1888.
-----------	--------------------------------

Commerce.

Justification of the improvement, '81, 1012; '83, 855.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 164; '82, 159; '83, 166; '84, 172; '85, 164; '86, 160; '87, 124.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips. Report, '81, 1010.

Capt. J. Mercur, 1881-'84. Reports, '81, 1009; '82, 1091; '83, 854.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1042.

Capt. W. H. Bixby, 1885-'—. Reports, '85, 1060; '86, 973; '87, 1013.

ASSISTANTS.

R. Whitford. Report, '81, 1010.

R. Ransom. Reports, '82, 1092; '83, 855; '84, 1042; '85, 1061; '86, 975; '87, 1015.

Operations.

History of operations, '86, 975.

1881-'82. Lower 25 miles of river cleared of obstructions; 420 feet of diking built, '82, 1072; '86, 976.

1882-'83. Obstructions cleared to a point 45 miles above the mouth, '83, 854; '86, 976.

1883-'84. 250 stumps removed, '84, 1042.

1884-'85. Removal of obstructions continued, '85, 1060; '86, 976.

1885-'86. Removal of obstructions from lower half of river; construction of 400 linear feet of pile dike; repair of old dikes, '86, 974, 976.

1886-'87. Removal of obstructions from lower half of river continued; dike and dam construction near the mouth, '87, 1014, 1015.

CONTENTNEA CREEK, N. C.—Continued.**Projects.**

By Capt. Phillips, 1861, for clearing the creek of obstructions and by dredging and diking so as to secure a depth of 3 feet during nine months of each year from the mouth to the town of Stantonburgh, a distance of about 70 miles. Estimated cost, \$40,000, '81, 1010, 1012. Estimate increased to \$78,000, '85, 1060, 1062; '87, 1013.

Surveys.

Ordered by act of June 14, 1860. Made under the direction of Capt. Phillips, 1860, '81, 1010.

Maps.

'87, 1014.

COOSA RIVER, GA. AND ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 159.)

Appropriations.

1876-'79	\$150,000
1880	75,000, '80, 1690.
1881	60,000, '81, 1873.
1882	83,700, '82, 1857.
1884	50,000, '84, 1656.
1886	45,000, '86, 1167.
Total	463,700
1888	60,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140, 188; '81, 189, 255; '82, 248; '83, 256; '84, 256; '85, 201; '86, 200; '87, 168.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1877-'85. Reports, '80, 1689; '81, 1870; '82, 1855; '83, 1561; '84, 1654.

Capt. R. L. Hoxie, 1885-'— . Reports, '85, 1301; '86, 1165; '87, 1281.

ASSISTANTS.

Lieut. W. L. Marshall. Report, '80, 1690.

Operations.

History of work since 1823, '81, 1870.

1879-'80. 1,039 cubic yards rock excavated from channel; 6,124 cubic yards rock quarried; 3,714 cubic yards rock placed in dams; 3,350 cubic yards gravel, etc., excavated; 12,756 cubic yards earth embankment raised, '80, 1689.

1880-'81. 4,219 cubic yards of masonry laid; 1,362 cubic yards stone quarried; 1,945 cubic yards solid and 12,645 cubic yards loose rock excavated; 7,040 cubic yards earth embankment raised, '81, 1872.

1881-'82. 3,154 cubic yards of masonry laid; 610 cubic yards dimension stone cut; 9,191 cubic yards stone quarried, and 14,312 cubic yards stone placed in dams and locks; 10,898 cubic yards earth and gravel placed in dams and embankments; 740 feet cribbing built, '82, 1856.

1882-'83. 7,686 cubic yards stone cut and quarried; 18,597 cubic yards stone and gravel placed in riprap dams; 359 cubic yards solid rock excavated; 1,140 cubic yards loose rock and gravel excavated; 2,016 cubic yards earth excavated, '83, 1562.

1883-'84. 634 cubic yards stone and gravel placed in riprap dams; 1,169 cubic yards solid rock excavated; 474 cubic yards of gravel, etc., excavated; lock gates for Lock No. 1 completed, '84, 1655.

1884-'85. 6,363 cubic yards stone cut; 4,406 cubic yards of stone built into locks; 1,922 cubic yards stone built into rubble dams; 3,093 cubic yards solid rock excavated; 9,846 cubic yards earth excavated, '85, 1302.

1885-'86. 1,055 cubic yards stone quarried and dressed; 143 cubic yards solid rock excavated from channel, '86, 1166.

1886-'87. Progress on lock and dam construction at Ten Island Shoals, and at Lock and Dam No. 4, '87, 1282.

COOSA RIVER, GA. AND ALA.—Continued.**Plans.**

By Capt. A. N. Damrell, 1880, for improvement of Coosa River from Selma, Rome and Dalton Railroad Bridge to city of Wetumpka, Ala., by a system of locks and dams, short stretches of canal, and removal of rocks from channel at various points. Estimated cost, \$2,649,949, '81, 1222.

Projects.

By Capt. King, 1877, for improvement of river from Greensport to Selma, Rome and Dalton Railroad bridge, by excavation of channel 80 feet wide and 4 feet deep at extreme low water, and by a system of locks and dams around Ten Island Shoals. Estimated cost, \$560,463, '77, 598; '81, 1871; '87, 1281.

Surveys.

Detailed survey of 24 miles of river below Lock No. 3, '82, 1856.

Ordered by act of March 3, 1879. Made under direction of Capt. Damrell, 1880, of Coosa River from Selma, Rome and Dalton Railroad bridge to Wetumpka, Ala., '81, 1221.

COOSAWATTEE RIVER, GA. (See OOSTENLAULA AND COOSAWATTEE RIVERS.)

(Continued from Vol. I, p. 169.)

COOSAWATTEE AND OOSTENLAULA RIVERS, GA. (See OOSTENLAULA AND COOSAWATTEE RIVERS, GA.)**COOS BAY, OREG.—IMPROVEMENT OF ENTRANCE.**

(Continued from Vol. I, p. 158.)

Appropriations.

1879.....	\$40,000
1881.....	30,000, '81, 2585.
1882.....	30,000, '83, 2677.
1884.....	30,000, '84, 2261.
1886.....	33,750, '86, 1992.

Total..... 163,750

1888..... 50,000, act of August 11, 1888.

Statement of appropriations, '87, 2461.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 940; '81, 328; '82, 321; '83, 334; '84, 338; '85, 365; '86, 361; '87, 325.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1879-'82. Reports, '80, 2323; '81, 2583.

Lieut. Col. C. Seaforth, 1882-'83. Report, '82, 2674.

Capt. C. E. Powell, 1883-'— . Reports, '83, 2055; '84, 2260; '85, 2388; '86, 1969; '87, 2460.

ASSISTANTS.

Lieut. A. H. Payson. Report, '80, 2326.

R. S. Littlefield. Reports, '81, 2585; '83, 2058; '84, 2262; '85, 2390.

Operations.

History of past operations, '81, 2586.

1879-'80. 450 linear feet of crib-work sunk, '80, 2325.

1880-'81. 250 linear feet crib-work sunk, '81, 2583.

1881-'82. Shore interval closed by addition of 210 linear feet crib-work; 7,236 cubic yards stone placed for jetty extension; 6 dump cars and 1 derrick car constructed, '82, 2675, 2676.

1882-'83. Jetty track repaired and extended; 14,063 cubic yards stone placed in jetty, making a total length of work of 1,645 linear feet, '83, 2056, 2057.

COOS BAY, OREG.—Continued.**Operations—Continued.**

1883-'84. 6,256 cubic yards rock placed, extending jetty 42 feet; 433 cubic yards rock placed in inside part of jetty, '84, 2260.

1884-'85. Enrockment advanced 72 feet; quarrying and sluicing operations carried on, '85, 2369.

1885-'86. No operations for lack of funds, '86, 1989.

1886-'87. Clearing quarry for use, '87, 2460.

Physical Characteristics.

Description of obstructions in Coos Bay, '80, 2324.

Influence exerted by jetties, '81, 2583.

Benefit conferred by improvement, '86, 1995, 1996, 1997.

Plans.

By Maj. Wilson, 1879, for improvement of entrance by construction of two stone training-walls to obtain 22-foot channel at low water. Estimated cost, \$972,000, '79, 1793, 1796.

Private and Corporate Work.

Continuation of operations during season of 1881-'82 after funds had been exhausted through materials and labor furnished by citizens, '82, 2676.

Projects.

By Maj. Gillespie, 1879, for construction of half-tide jetty, from near Fossil Point, in a curved line toward Coos Head. Estimated cost, \$600,000, '80, 2323; '83, 2055; '87, 2460.

Surveys.

Examination into condition of jetty, channel, and sand spits, '85, 2389.

Survey of entrance and outer harbor, 1886, '86, 1989.

MAPS.

'82, 2676; '83, 2060; '84, 2264; '85, 2390; '86, 1939.

COQUILLE RIVER, OREG.—IMPROVEMENT OF ENTRANCE TO.

(Continued from Vol. I, p. 160.)

Appropriations.

1880..... \$10,000, '80, 241.

1882..... 10,000, '82, 2683.

1884..... 10,000, '84, 2271.

1886..... 20,000, '86, 2004.

Total 50,000

1888..... 25,000, act of August 11, 1888.

Statement of appropriations, '87, 2459.

Commerce.

Commercial statistics, '85, 2401.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 241; '81, 330; '82, 322; '83, 336; '84, 339; '85, 366; '86, 362; '87, 325, 330.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1880-'82. Report, 81, 2596.

Capt. C. F. Powell, 1882-'— . Reports, '82, 2682; '83, 2068; '84, 2270; '85, 2398; '86, 2003; '87, 2458, 2498.

ASSISTANT.

R. S. Littlefield. Reports, '81, 2598; '83, 2070; '85, 2400.

Operations.

History of operations, '81, 2599.

1880-'81. 50 linear feet of riprap jetty, with central core of timber boxes constructed, '81, 2597.

1881-'82. Addition of 100 linear feet to jetty and temporary elevation to high-water line by addition of plank parapet; cribs riprapped, '82, 2682, 2633.

1882-'83. Jetty extended by 360 linear feet piling and 58 linear feet riprap, '83, 2069.

1883-'84. No operations for lack of funds.

1884-'85. 422 linear feet close piling driven; 860 cubic yards stone ballast quarried and placed in jetty, '85, 2399.

1885-'86. No operations for lack of funds.

1886-'87. Extension of pile jetty to a length of 1,626 feet, '87, 2458.

COQUILLE RIVER, OREG.—Continued.**Plans.**

By Capt. Powell, 1887, for improvement of river by snagging between Coquille City and Myrtle Point, at a cost of \$5,000, '87, 2499.

Private and Corporate Work.

Elevation of jetty by private work, '83, 2068.

Projects.

By Maj. Wilson, 1878, for improvement of the bar at the mouth, so as to give a channel 10 feet deep at mean low water, by construction of training-walls. Estimated cost, \$164,200, '79, 1808, 1810; '81, 2599.

Surveys.

Made, 1880, under direction of Maj. Gillespie, '81, 2596.

Examination into condition of channel and jetty, '84, 2270.

Examination ordered between Coquille and Myrtle Point by act of August 5, 1886.

Made, 1887, under direction of Capt. Powell, '87, 2499.

MAPS.

'82, 2682; '83, 2072; '84, 2270; '85, 2400. Mouth of, '86, 2003.

CORNAY RIVER, LA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 263.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887. Report, '87, 1489.

Physical Characteristics.

River obstructions, '87, 1489.

Plans.

Capt. Willard, 1887, reports the improvement of the river as unnecessary and not a public necessity, '87, 1489.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Willard, '87, 1489.

CORNELL'S LANDING AND JAMAICA BAY, N. Y.—SURVEY FOR WATER CONNECTION BETWEEN.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '80, 85; '81, 108.

ENGINEER IN CHARGE.

Col. J. Newton. Report, '81, 671.

ASSISTANT.

R. H. Talcott. Report, '81, 672.

Plans.

By Col. Newton, 1880, for dredging channel from 60 to 70 feet wide, with a depth of 2 feet at mean low water, from Jamaica Bay to Cornell's Landing. Estimated cost, \$29,900, '81, 673.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under the direction of Col. Newton, '81, 671.

CORPUS CHRISTI, TEX. (See ARANSAS PASS, TEX.)**CORSICA CREEK, MD.—SURVEY AND IMPROVEMENT OF.****Appropriations.**

1882.....	\$5,000, '82, 842.
1884.....	5,000, '84, 892.
1886.....	10,000, '86, 867.
1888.....	10,000, act of August 11, 1888.

CORSICA CREEK, MD.—Continued.**Commerce.**

Justification of the improvement, '86, 869.

Contracts.

1883. American Dredging Company, for dredging, at 18 cents per cubic yard, '84, 891.

1884. Baltimore Dredging Company, for dredging, at 13 cents per cubic yard, '85, 884.

1886. National Dredging Company, for dredging, at 11 cents per cubic yard, '87, 839, 840.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 150; '82, 129; '83, 134; '84, 141; '85, 133; '86, 131; '87, 93.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1881-'84. Reports, '82, 842; '83, 668; '84, 891.

Maj. W. H. Heuer, 1884. Report, '85, 867.

W. F. Smith, U. S. Agent, 1884— . Report, '85, 884; '86, 867; '87, 838.

Operations.

1883-'84. 23,514 cubic yards dredged from channel near Centerville, '84, 891.

1884-'85. 24,569 cubic yards dredged in extension of previous work, '85, 884.

1885-'86. No operations, '86, 867.

1886-'87. 77,390 cubic yards dredged from channel and turning basin, '87, 839.

Private and Corporate Work.

Dredging done by private enterprise, '87, 839.

Projects.

By Lieut. Col. Craighill, 1882, for the formation of a dredged channel from Hooper's Landing to Centerville, 100 feet wide and 8 feet deep at mean low water; also a turning basin at Centerville 200 by 300 feet. Estimated cost, \$30,000, '82, 842.

Surveys.

Ordered by act of March 3, 1881. Made under the direction of Col. Craighill, 1881 '82, 842.

Maps.

'87, 838.

CORSON'S SOUND, N. J. (See TOWNSHEND'S INLET.)**COTTAGE CITY HARBOR, MASS.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 43.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Elliot, 1886. Report, '87, 568.

Physical Characteristics.

Description, '87, 569.

Plans.

Lieut. Col. Elliot, 1886, reports improvement of Cottage Harbor as unjustifiable in view of existing commerce, '87, 569.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Elliot, '87, 569.

COUNCIL BLUFFS, IOWA. (See MISSOURI RIVER, BETWEEN MOUTH AND SIOUX CITY, IOWA.)**COWLITZ RIVER, WASH.—IMPROVEMENT OF**

(Continued from Vol. I, p. 161.)

Appropriations.

1880.....	\$2,000, '81, 2601.
1881.....	1,000, '81, 2601.

COWLITZ RIVER, WASH.—Continued.**Appropriations—Continued.**

1882.....	\$1,000, '82, 2685.
1884.....	2,000, '84, 2273.
1886.....	2,000, '86, 1952.

Total 8,000

1888..... 3,000, act of August 11, 1888.

Statement of appropriations, '87, 2525.

Commerce.

Importance of improvement, '81, 2600.

Contracts.

1884. J. Kellogg & Co., for construction of 300 feet of wing-dam, '85, 2439.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 241, 242; '81, 331; '82, 323; '83, 336; '84, 339; '85, 371; '86, 359; '87, 333.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1879-'82. Reports, '80, 2331; '81, 2600.

Capt. C. F. Powell, 1882-'85. Reports, '82, 2684; '83, 2073; '84, 2272.

Maj. W. A. Jones, 1885-'—. Reports, '85, 2439; '86, 1952; '87, 2524.

ASSISTANT.

R. A. Habersham. Reports, '80, 2232; '81, 2601.

Operations.

1880-'81. 40 miles of river cleared by removal of snags and trees, '81, 2600.

1881-'82. 304 snags and trees removed, '82, 2684.

1882-'83. 483 logs, snags, and trees removed, '83, 2073.

1883-'84. No operations for lack of funds.

1884-'85. 300 linear feet wing-dam built by contract, '85, 2439.

1885-'86. No operations for lack of funds.

1886-'87. 190 linear feet wing-dams built; 315 snags removed, '87, 2525.

Projects.

By Maj. Gillespie, 1879, for improvement of river from mouth to Cowlitz Landing by removal of snags and scraping of bars. Estimated cost, \$5,000 for the first year with an annual expenditure thereafter of \$2,000, '81, 2603; '86, 1952.

Surveys.

Ordered by act of March 3, 1879. Made under direction of Maj. Gillespie, 1879, '80, 2331.

CRESCENT CITY HARBOR, CAL.—EXAMINATION OF, WITH A VIEW TO A SEA-WALL FROM BATTERY POINT TO FLAT ROCK.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 324.

ENGINEER IN CHARGE.

Capt. A. H. Payson, 1887. Report, '87, 2454.

Plans.

Capt. Payson, 1887, reports an improvement as unadvisable, in view of large cost of same, '87, 2455.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Payson, '87, 2454.

CROOKED RIVER, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 149; '82, 180.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1314.

CROOKED RIVER, FLA.—Continued.**Plans.**

By Capt. Damrell, 1882, for deepening by dredging the channel over the bar and a short distance above to a depth of 13 feet. Estimated cost, \$72,000, '82, 1314.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Damrell, '82, 1314.

CROSS VILLAGE HARBOR, MICH.—EXAMINATION FOR HARBOR OF REFUGE AT.**Commerce.**

Commercial statistics, '84, 1296, 1298.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 301; '85, 332.

ENGINEERS IN CHARGE.

Maj. D. P. Heap. Report, '84, 1995.

Capt. D. W. Lockwood. Report, '84, 1996.

Lieut. Col. O. M. Poe. Report, '85, 2185.

ASSISTANTS.

J. A. Mitchell. Report, '84, 1997.

O. B. Wheeler. Report, '85, 2185.

Physical Characteristics.

Locality described, '84, 1995, 1997; '85, 2185.

Plans.

In 1883 Capt. Lockwood estimated that to obtain a sheltered area of 20 acres would involve an expenditure of \$300,000, but considered that the advantage to commerce would be purely local, '84, 1997, 1998.

In 1884 Col. Poe considered that the locality as a harbor of refuge was not worthy of improvement by the General Government, '85, 2185.

Surveys.

Examinations ordered by acts of August 2, 1882, and July 5, 1884. Made under the directions of Maj. Heap, Capt. Lockwood, and Col. Poe, '84, 1995, 1996; '85, 2185.

CRYSTAL RIVER, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1316.

ASSISTANT.

P. Robinson. Report, '82, 1317.

Plans.

For the formation by dredging and blasting of a channel 6 feet deep through the shoals at the mouth. Estimated cost, \$115,000, '82, 1317.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Damrell, '82, 1316.

CUivre RIVER, MO.—IMPROVEMENT OF.

(Continued from Vol. I, p. 163.)

Appropriations.

1880..... \$2,000, '80, 1550.

1881..... 5,000, '81, 1730.

1882..... 5,000, '82, 1793.

Contracts.

1881. H. S. Brown & Co., for dredging, at 25 and 20 cents per cubic yard, '81, 1729.

1882. H. S. Brown & Co., for dredging, at 22½ cents per cubic yard, '83, 1429.

CUivre RIVER, MO.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 176, 177; '81, 237; '82, 235; '83, 242.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1879. Reports, '80, 1549, 1550; '81, 1729; '82, 1733; '83, 1429.

ASSISTANT.

C. W. Durham. Report, '80, 1551.

Operations.

1880-'81. 19,319 cubic yards material dredged; 13,609 snags and trees removed and felled, '81, 1729.

1881-'82. No operations, '82, 1793.

1882-'83. 20,000 cubic yards material dredged; snags and trees removed, '83, 1429.

Physical Characteristics.

Description of river and obstructions, '80, 1552.

Projects.

By Capt. Mackenzie, 1879, for improvement by dredging channel from 80 to 100 feet wide and 2 feet deep, low water, through the shoals, the construction of a brush and rock dam across lower part of Cuivre Slough, and the removal of snags, wrecks, and obstructions. Estimated cost, \$30,000, '80, 1553.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Capt. Mackenzie, '80, 1550.

CUMBERLAND RIVER (above Nashville)—IMPROVEMENT OF.

(Continued from Vol. I, p. 163.)

Appropriations.

1876-'79.....	\$151,000
1880. Nashville to Kentucky line.....	15,000, '80, 1676.
Kentucky line to Smith's Shoals.....	10,000, '80, 1677.
Smith's Shoals.....	20,000, '80, 1677.
1881. Nashville to Kentucky line.....	15,000, '81, 1851.
Kentucky line to Smith's Shoals.....	15,000, '81, 1851.
Smith's Shoals.....	10,000, '81, 1853.
Above mouth of Jellico.....	10,000, '81, 1853.
1882. Kentucky line to Smith's Shoals.....	30,000, '82, 1845.
Smith's Shoals.....	15,000, '82, 1846.
Above mouth of Jellico.....	5,000, '82, 1847.
1884. From Nashville to foot of Smith's Shoals....	50,000, '84, 1648.
1886. From Nashville to head of Smith's Shoals...	75,000, '86, 1517.
Total.....	421,000
1888.....	200,000, act of August 11, 1888.

Commerce.

Statistics, '80, 1678; '86, 1518.

Commercial and agricultural resources of country bordering on the Cumberland River, '81, 1854.

Resources of Upper Cumberland, '84, 1670.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 185; '81, 250, 258; '82, 244, 252; '83, 232; '84, 253; '85, 275; '86, 206; '87, 234.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1876-'86. Reports, '80, 1675; '81, 1850, 1854; '82, 1844, 1808; '83, 1489; '84, 1647, 1661, 1662, 1663; '85, 1762.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1516; '87, 1760.

ASSISTANTS.

Capt. L. C. Overman. Report, '80, 1678.

Lieut. W. L. Marshall. Report, '81, 1854.

W. C. Crozer. Report, '82, 1865.

G. A. Tarrill. Report, '84, 1667.

CUMBERLAND RIVER (above Nashville)—Continued.**Operations.**

- 1879-'80. Nashville to Kentucky line: 985 cubic yards rock, 6,982 cubic yards of gravel, and 100 snags removed; 4,323 cubic yards rock quarried and 5,884 cubic yards dam built; also 596 snags, logs, and trees removed. Kentucky line to Smith's Shoals: 1,196 snags, logs, and trees, and 50 cubic yards of boulders removed. Smith's Shoals: 15,652 cubic yards loose and solid rock and gravel excavated from the channel, 4,403 cubic yards rock quarried, and 11,993 cubic yards dam built. Smith's Shoals to Falls of Cumberland: 218 cubic yards rock removed, '80, 1676, 1677, 1678.
- 1880-'81. Nashville to Kentucky line: 10,269 cubic yards rock and gravel excavated, 1,847 cubic yards of rock quarried, and 4,854 cubic yards of rock placed in dams and bank riprap. Kentucky line to Smith's Shoals: 5,139 cubic yards rock and gravel excavated, 1,094 cubic yards rock quarried, and 3,970 cubic yards placed in dams and riprap. Smith's Shoals: 4,710 cubic yards loose and solid rock excavated from channel, 2,038 cubic yards masonry and concrete laid, 4,676 cubic yards stone quarried, and 12,217 placed in dams, '81, 1850, 1851, 1852.
- 1881-'82. Nashville to Kentucky line: 10,808 cubic yards rock quarried and 12,215 placed in dams, 8,585 cubic yards gravel, 830 cubic yards rock, and 376 snags removed. Kentucky line to Smith's Shoals: 3,789 cubic yards rock quarried and 7,048 cubic yards of same placed in dams, 13,518 cubic yards rock and gravel and 516 snags removed. Smith's Shoals: 3,264 cubic yards rock quarried, 8,700 cubic yards placed in dams, and 210 cubic yards excavated from channel. Above mouth of Jellico: 2,414 cubic yards rock excavated and 769 snags and trees removed, '82, 1844, 1845, 1846.
- 1882-'83. Nashville to foot of Smith's Shoals: 4,700 cubic yards rock quarried and 16,184 cubic yards placed in dams, 5,090 cubic yards rock, 410 snags, and 2 wrecks removed. Smith's Shoals: 655 cubic yards rock excavated from channel, 3,424 cubic yards rock quarried and 4,129 placed in dams, '83, 1489, 1490.
- 1883-'84. Nashville to foot of Smith's Shoals: 360 cubic yards material dredged, 550 snags and trees removed, and 1,475 cubic yards rock placed in dams, '84, 1647.
- 1884-'85. Nashville to head of Smith's Shoals: 370 linear feet of dam built, containing 1,007 cubic yards of rock; 480 cubic yards rock, 341 snags, and 69 trees removed; 8,812 cubic yards rock quarried and 1,955 linear feet riprap dam built; 6,010 cubic yards rock and gravel removed at Upper Nashville Island; 809 cubic yards rock and gravel excavated and 1,543 cubic yards riprap dam built at Waitsborough Shoals, '85, 1762, 1763.
- 1885-'86. Nashville to head of Smith's Shoals: 1,249 cubic yards solid rock, 200 cubic yards sand and gravel, and 463 cubic yards riprap dam removed; 2,710 cubic yards stone quarried and 1,904 cubic yards riprap dam built, '86, 1516.
- 1886-'87. Nashville to head of Smith's Shoals: At Smith's, Forbush, and Priestly's Shoals 133 cubic yards solid rock and 1,545 cubic yards loose rock removed; 1,365 cubic yards of embankment built and 1,072 cubic yards of stone placed in dams, '87, 1761. No operations above the mouth of the Jellico, '87, 1762.

Physical Characteristics.

Description of Smith's Shoals, '82, 1865.

Plans.

By Maj. King, 1881, for the improvement of Smith's Shoals by locks and dams, using the river itself as a canal, by the construction of a dam at head of Mill Shoal in connection with 4 locks of 16 feet lift and 55 by 140 feet in chambers. Estimated cost, \$560,000, or for a more complete improvement an additional dam, with 3 locks near Shadowen Shoal, at an estimated cost of \$965,000, '82, 1863, 1864.

Recommended that present system of dams be tried one year longer before attempting a more radical improvement, '82, 1865.

Private and Corporate Work.

Value and description of the private dams above the mouth of the Jellico, '83, 1491, 1492; '87, 1762, 1763.

Projects.

By Maj. Weitzel, 1872, for the improvement of the river from the Falls of the Cumberland to Nashville, 372 miles, by excavation of ledges, sand, and gravel bars, concentration of water by wing-dams, removal of snags and boulders, and the restriction of tributaries to determined channels. Estimated cost, \$258,864, '71, 470, 478; '72, 471; '77, 594.

By Maj. McFarland, 1875, for the improvement of Smith's Shoals by wing-dams so as to give descending coal-boats a depth of 4 feet during mean high water, '75, 1, 736, 736.

CUMBERLAND RIVER (above Nashville)—Continued.**Projects—Continued.**

In 1884 Maj. King proposed for the improvement of the river from Nashville to the head of Smith's Shoals a slack-water system by means of locks and dams, giving a depth of 5 feet on the lower miter-sills. Estimated cost, \$4,077,922, '84, 1863, 1865; '87, 1761.

Dimensions of locks as fixed by Board of Engineers, 280 feet long, 52 feet wide, '87, 1760.

Above mouth of Jellico: By Maj. King, 1881, for improvement of river between Jellico and Cumberland Ford, a distance of 110 miles, by removal of snags, trees, and similar obstructions. Estimated cost, \$55,000, '81, 1853; '87, 1763.

Surveys.

For canal around Smith's Shoals ordered by act of March 3, 1881. Made under direction of Maj. King, '82, 1862.

Examination of Cumberland River and principal tributaries above Pineville. Made, 1882, under direction of Maj. King, '84, 1661.

Examination and survey, with view to location of locks and dams on river, from Nashville to Cincinnati Southern Railroad. Made, 1882, 1884, under direction of Maj. King, '84, 1662, 1663.

CUMBERLAND RIVER (below Nashville)—IMPROVEMENT OF.

(Continued from Vol. I, p. 163.)

Appropriations.

1832-'79	\$340,000
1890	20,000, '80, 1675.
1881	15,000, '81, 1850.
1882	15,000, '82, 1841.
1884	7,500, '84, 1647.
1886	12,500, '86, 1517.

Total..... 410,000

1888..... 10,000, act of August 11, 1888.

Commerce.

Extension of season of navigation, '84, 1645.

Statistics, '85, 1761.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 185; '81, 249; '82, 244; '83, 251; '84, 252; '85, 274; '86, 266; '87, 233.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1876-'86. Reports, '80, 1674; '81, 1849; '82, 1843; '83, 1487; '84, 1644; '85, 1760.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1515; '87, 1758.

Operations.

1879-'80. 571 cubic yards rock, 5,535 cubic yards gravel, and 52 snags removed from the channel; also 19,510 cubic yards of rock quarried and 23,453 cubic yards of dam built. The work was done at Palmyra Island and Harpeth, Dover, Ingram, Race Track, and Little River shoals, '80, 1675.

1880-'81. 676 snags, roots, and overhanging trees removed, and 11,367 cubic yards rock quarried and 23,206 cubic yards dam built, '81, 1850.

1881-'82. 583 snags and roots, 305 cubic yards gravel, and 67 cubic yards rock removed from channel; also 6,390 cubic yards rock quarried and built into dams, '82, 1844.

1882-'83. 938 snags, 1,628 cubic yards rock and gravel, and 2 wrecks removed; 3,397 cubic yards rock placed in dams and 740 linear feet brush dam built, '83, 1489.

1883-'84. 200 cubic yards material dredged, 1,778 cubic yards rock quarried, and 1,240 cubic yards rock put in dams, '84, 1646.

1884-'85. 1,100 cubic yards rock quarried and placed in dams, 128 snags and 2,595 cubic yards gravel removed, '85, 1761.

1885-'86. 171 cubic yards stone quarried and 230 cubic yards riprap dam built; 12 snags, 276 cubic yards sand and gravel, and 361 cubic yards of loose rock removed, '86, 1515.

1886-'87. 26 snags and 15 trees removed from river between Nashville and Roberson Island, '87, 1758.

CUMBERLAND RIVER (below Nashville)—Continued.**Projects.**

From 1833 to 1871, inclusive, \$185,000 was appropriated for this part of the river, '74, i, 578.

By Maj. Weitzel, 1872, for improvement of the Cumberland River below Nashville, so as to give a low-water depth of 3 feet, by excavation of ledges, sand and gravel bars, removal of snags and bowlders, concentration of water by wing-dam construction, and restriction of tributaries to determined channels. Estimated cost, \$243,821, '71, 480; '72, 462. Total estimated cost of improvement increased in 1884 to \$348,000, '84, 1646; '87, 1759.

CUMBERLAND RIVER, KY. (South Fork of)—IMPROVEMENT OF.**Appropriations.**

1832..... \$3,000, '82, 1862.
 1884..... 4,000, '84, 1661.
 1886..... 5,000, '86, 1525.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 190; '81, 258; '82, 252; '83, 259; '84, 259; '85, 279; '86, 270; '87, 235.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1881-'86. Reports, '81, 1896; '82, 1862; '83, 1508; '84, 1660; '85, 1770.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1525; '87, 1765.

ASSISTANT.

W. C. Crozer. Report, '81, 1897.

Operations.

1882-'83. Brush dam built, 50 trees cut, 80 cubic yards stone quarried for dams, '83, 1508.

1883-'84. No operations for lack of funds, '84, 1661.

1884-'85. 556 cubic yards solid rock blasted, 368 cubic yards loose rock excavated, 108 cubic yards stone quarried for riprap, 1,665 cubic yards riprap dam built, 161 trees cut and removed, '85, 1770.

1885-'86. No operations for lack of funds, '86, 1525.

1886-'87. 230 cubic yards solid and 583 cubic yards loose rock removed, 2,066 cubic yards stone placed in wing-dams at Sloan's and Robert's shoals, '87, 1765.

Projects.

By Maj. King, 1881, for improvement of about 44 miles of river below Devil's Jump, by removal of gravel bars and bowlders, excavating channel through rocky reefs, and construction of wing-dams, so as to secure safe navigation at stages of the river when at least 3 feet above low water. Estimated cost, \$62,803, '81, 1897, 1898; '86, 270; '87, 235.

Surveys.

Ordered by act of June 18, 1878. Made, 1879, under direction of Maj. King, '81, 1896.

CUMBERLAND SOUND, FLA. AND GA.—IMPROVEMENT OF ENTRANCE TO.

(Continued from Vol. I, p. 166.)

Appropriations.

1880..... \$30,000, '80, 966.
 1881..... 100,000, '81, 1123.
 1882..... 50,000, '82, 1187.
 1884..... 75,000, '84, 1123.
 1886..... 112,500, '86, 1121.

Total 367,500

1886..... 112,500, act of August 11, 1883.

Statement of appropriations, '87, 1195.

Commerce.

Benefit to be conferred by improvement, '81, 1122; '87, 1194.

CUMBERLAND SOUND, FLA. AND GA.—Continued.**Contracts.**

1886. Lara, Ross & Co., for jetty construction, '81, 1121.
 1891. A. M. Newton, for jetty construction, '82, 1187.
 1892. Lara & Ross, for jetty construction, '83, 936.
 1894. Lara & Ross, for jetty construction, at 59 cents per square yard for mattress and \$3.69 per cubic yard for stone, '85, 1232.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 130, 136; '81, 176; '82, 172; '83, 182; '84, 189; '85, 189; '86, 189; '87, 152.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1876—'. Reports, '80, 965, 1036; '81, 1120; '82, 1183; '83, 931; '84, 1121; '85, 1229; '86, 1118; '87, 1191.

ASSISTANTS.

G. Daubeney. Report, '80, 1037.

Lieut. W. L. Fisk. Report, '81, 1124.

Capt. J. C. Post. Reports, '82, 1188; '83, 938.

Lieut. W. T. Russell. Reports, '83, 935; '84, 1123.

W. R. Curtis. Report, '85, 1232.

Lieut. O. M. Carter. Reports, '86, 1122; '87, 1196.

Operations.

1890-'81. 276 linear feet of apron foundation laid and covered with riprap stone, '81, 1121.

1891-'82. Apron foundation of north jetty extended 2,010 feet, bottom course extended 7,196 feet, 10,824 cubic yards stone deposited on work, apron foundation of south jetty extended 1,316 feet, 2,443 cubic yards riprap stone deposited, '82, 1184, 1185.

1892-'83. Second course mattress north jetty extended 73 feet, foundation mats for spurs placed and covered with riprap stone, 4,475 cubic yards stone used, foundation course of south jetty extended 2,851 feet, 7,350 cubic yards riprap placed, '83, 933.

1893-'84. No operations for lack of funds.

1894-'85. Bottom course of Smith Jetty advanced 3,507 feet, 13,487 cubic yards riprap used, '85, 1230.

1895-'86. No operations for lack of funds.

1896-'87. 33,303 square yards of mattress foundation and 10,336 cubic yards of stone placed in jetties, '87, 1193.

Projects.

By Lieut. Col. Gillmore, 1879, for two low jetties of riprap stone resting on a foundation of mattresses of logs and brush, starting from the shores on opposite sides of the entrance and extending seaward across the bar with outer ends parallel to each other and from 3,000 to 3,500 feet apart, designed to give a low-water channel 20 to 21 feet deep. Estimated cost, \$2,071,023, '79, 793; '80, 965; '86, 189; '87, 1191.

Surveys.

Ordered by act of June 14, 1890. Made, 1890, under direction of Lieut. Col. Gillmore, '80, 1036; '86, 1120; '87, 1183.

Maps.

'83, 934; '85, 1232.

CURRENT RIVER, MO. AND ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 167.)

Appropriations.

1872-'79 \$5,000

1881 2,000, '81, 1517.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213, 219; '82, 217; '83, 224.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1880-'82. Report, '81, 1467, 1517.

Capt. T. H. Handbury, 1882—'. Reports, '82, 1586; '83, 1175.

Operations.

1881-'82. 180 snags removed, 3,000 overhanging trees cut, '82, 1586.

1892-'83. 85 snags removed, '83, 1175.

CURRENT RIVER, MO. AND ARK.—Continued.**Projects.**

By Maj. Benyaud, 1880, for concentration of water over shoal places by means of brush and stone wing-dams, and for removal of snags, logs, and trees from channel. Estimated cost, \$17,365, '81, 1517.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Benyaud, '81, 1467.

CURRIOMAN BAY, VA.—SURVEY OF MOUTH OF.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '80, 117, 158; '81, 158.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1880. Report, '81, 982.

Plans.

By S. T. Abert, 1881, for improvement by dredging channel through bar 2,050 feet long, 150 feet wide, and 11 feet deep at low water. Estimated cost, \$8,278, '81, 983.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of S. T. Abert, '81, 982.

CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 167.)

Appropriations.

1878-'79	\$45,000
1880	25,000, '80, 828.
1881	30,000, '81, 998.
1882	20,000, '82, 1062.
1884	5,000, '84, 1035.
1886	10,000, '86, 965.

Total	135,000
1888	7,500, act of August 11, 1888.

Contracts.

1879. G. H. Ferris, for dredging, at 15½ cents per cubic yard, '80, 827.

1-80. National Dredging Company, for dredging, at 14 cents per cubic yard, '81, 997.

1881. J. Caler & Co., for dredging, at 17½ cents per cubic yard, '82, 1081. V. Freeman, for dredging, at 25 cents per cubic yard, '83, 847.

1884. G. E. Ward, for dredging, at 14½ cents per cubic yard, '85, 1039.

1886. J. Caler & Son, for dredging, at 13¾ cents per cubic yard; failure to complete contract, '87, 986.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 120; '81, 161; '82, 157; '83, 163; '84, 167; '85, 159; '86, 154; '87, 119.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'81. Reports, '80, 827; '81, 999.

Capt. J. Mercur, 1881-'84. Reports, '81, 996; '82, 1080; '83, 846.

Capt. F. A. Hinman, 1884-'—. Reports, '84, 1034; '85, 1039; '86, 965; '87, 986.

ASSISTANT.

G. H. Elliott. Report, '80, 829.

Operations.

1879-'80. 47,893 cubic yards material dredged, '80, 828.

1-80-'81. 18,862 cubic yards material dredged, '81, 997, 999.

1881-'82. 93,083 cubic yards material dredged; 92,000 linear feet of bank constructed; piles driven for bulkhead, '82, 1081, 1082.

1882-'83. 37,441 cubic yards material dredged; 26,826 bushels of oyster shells placed in shell dike, '83, 847.

1883-'84. 10,079 cubic yards material dredged, '84, 1034.

1884-'85. 35,000 cubic yards material dredged, '85, 1039.

CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, N. C.—Continued.**Operations—Continued.**

1885-'86. No operations for lack of funds, '86, 965.

1886-'87. 1,037 cubic yards dredged from North River Bar, '87, 986.

Projects.

By Capt. Phillips, 1878, to secure through Currituck Sound, by dredging, a channel 80 feet wide and 9 feet deep at ordinary winter stage of water. Estimated cost, \$90,000, '79, 693; '80, 827.

By Capt. Phillips, 1880, for improvement of Coanjok Bay by dredging channel same dimensions as above, to be protected on western side by an oyster shell dike 9,200 feet in length. Estimated cost, \$50,213.95, '81, 1,000.

By Capt. Hinman, 1886, for improvement of North River Bar, by excavation of channel 7,150 feet long, 150 feet wide, and 9.4 feet deep at ordinary low water; also construction of two range-lights to mark channel. Estimated cost, \$55,122, '85, '86, 155.

Surveys.

Of Coanjok Bay. Made, 1880, under direction of Capt. Phillips, '81, 999.

CUYAHOGA RIVER. (See CLEVELAND, OHIO, EXAMINATION OF OLD RIVER BED at.)**CYPRESS BAYOU, TEX. AND LA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 168.)

Appropriations.

1872-'79 \$94,000

1886 18,000, '86, 1348.

1888 5,000, act of August 11, 1888.

List of appropriations, '80, 1281; '87, 1454.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 151; '81, 212; '82, 209; '83, 218; '84, 223; '85, 233, 244; '86, 229; '87, 194, 203.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1874-'83. Reports, '80, 1280; '81, 1428; '82, 1561.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1161; '84, 1332.

Capt. E. Bergland, 1885-'86. Reports, '85, 1493, 1552; '86, 1347.

Capt. J. H. Willard, 1886-'— Report, '87, 1453, 1494.

ASSISTANT.

F. S. Burrowes. Report, '85, 1553.

Operations.

1879-'80. 2,102 stumps and snags removed from channel, 326 trees cut down, '80, 1280. 1880-'84. No operations, '84, 1332.

1884-'85. 335 trees cut, 60 snags removed, 315 feet of sand-bars washed out, '85, 1493.

1885-'86. No operations for lack of funds, '86, 1347.

1886-'87. Rebuilding dredge-boat, '87, 1453.

Plans.

By Maj. Howell, 1874, for construction of dam across the lake at Albany Point and excavation of cut through to Red River. Estimated cost, \$372,580, '80, 1281; '87, 1454, 1494.

Projects.

By Capt. Howell, 1872, for removal of obstructions and clearance of a channel through Cypress Bayou. Estimated cost, \$50,000, '73, 622. Completed in 1880, '80, 1280; '86, 229.

By Capt. Bergland, 1885, for straightening and marking present channel, cutting stumps, and reopening cuts by dredging. Estimated cost, \$18,000, '85, 1494; '87, 194.

Surveys.

Ordered by act of July 5, 1884, of Cypress Bayou and lakes between Jefferson, Tex., and Shreveport, La. Made, 1885, under direction of Capt. Bergland, '85, 1552.

Examination of Cypress Bayou, La., ordered by act of August 5, 1886. Made under direction of Capt. Willard, '87, 1494.

DAN RIVER, VA. AND N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 168.)

Appropriations.

1880.....	\$10,000, '80, 790.
1881.....	8,000, '81, 978.
1882.....	7,500, '82, 1056.
1884.....	5,000, '84, 1000.
1886.....	20,000, '86, 927.

Total..... 50,500

Statement of appropriations, '87, 954.

Commerce.

Commercial statistics, '82, 1055.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 116, 117; '81, 157; '82, 152; '83, 159; '84, 161; '85, 151; '86, 146; '87, 112.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1878.—. Reports, '80, 788, 794; '81, 977; '82, 1053; '83, 830; '84, 1000; '85, 993; '86, 925; '87, 951.

Operations.

1880-'81. Two derrick boats and two scows built; 281 cubic yards solid rock blasted, 115 cubic yards loose rock, sand, and gravel removed, '81, 978.

1881-'82. 2,590 cubic yards solid rock blasted; 482 cubic yards loose rock, sand, and gravel removed; 774 cubic yards rock used in dams, '82, 1054.

1882-'83. 1,055 cubic yards rock quarried for spur-dams, '83, 830.

1883-'84. 680 cubic yards rock and 28 cubic yards gravel removed; 194 cubic yards of rock quarried, '84, 1000.

1884-'85. 421 cubic yards rock excavated; 789 cubic yards rock quarried; 649 cubic yards placed in dams, '85, 994.

1885-'86. 125 cubic yards rock removed, '86, 926.

1886-'87. Improvement of shoals in progress between Long and Adams Island shoals, '87, 954.

Physical Characteristics.

Detailed description of obstructions, '80, 797.

Projects.

By S. T. Abert, 1879, for securing channel 35 feet wide with a depth of 3 feet at low water for a distance of 77 miles by dredging, rock excavation, and construction of locks and dams. Estimated cost, \$6,585.79, '79, 666, 671; '80, 788. Revised in 1880 for channel 16 feet wide with a depth of 1½ feet in pools and 2 feet in rapids without locks and dams. Estimated cost, \$52,000, '80, 788. Increased \$5,500 in 1886-'87, '86, 147; '87, 954.

Surveys.

From Danville to Clarksville, ordered by act of March 3, 1879. Made, 1880, under direction of S. T. Abert, '80, 794.

Resurvey of Seven Shoals made, '86, 926.

Maps.

Profile, '86, 927.

Madison to Danville, '87, 954.

D'ARBONNE RIVER, LA. (See BATOU D'ARBONNE, LA.)**DABBY CREEK, PA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 56.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert. Report, '87, 822.

Physical Characteristics.

Description of creek, '87, 822.

DARBY CREEK, PA.—Continued.**Plans.**

Lieut. Col. Robert, 1886, reports the creek as unworthy of improvement in view of the small prospective commerce and probable lack of permanence in the channel, '87, 823.

Surveys.

Examination ordered by act of August 4, 1886. Made, 1886, under direction of Lieut. Col. Robert, '87, 822.

DARIEN HARBOR (RIVER), GA.—SURVEY OF.

(Continued from Vol. I, p. 169.)

Appropriations.

1878-79 \$8,000

Commerce.

Justification of improvement, '85, 1238-1242.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 191.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore. Report, '85, 1234, 1237.

ASSISTANT.

Capt. T. N. Bailey. Report, '85, 1236, 1239.

Physical Characteristics.

Description of river, '85, 1235, 1237, 1241.

Plans.

By Col. Gillmore, 1885, for the improvement of the river between Darien and Doboy, a distance of about 10 miles, by the formation of a channel through the shoals below Darien 12 feet deep at low water, the channel to be obtained by dredging and maintained by the construction of wing-dams. Estimated cost, \$170,000, '85, 1238, 1242.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Col. Gillmore, '85, 1237.

DAUPHIN ISLAND AND CEDAR POINT, ALA.—SURVEY OF SHOAL BETWEEN.**Commerce.**

Justification of improvement, '84, 1228.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 206.

ENGINEER IN CHARGE.

Maj. A. N. Damrell. Report, '84, 1227, 1228.

ASSISTANT.

C. B. Percy. Report, '84, 1229.

Physical Characteristics.

Route described, '84, 1229.

Plans.

By Maj. Damrell, for the formation of dredged channels through either Pass Aux Herons or Grant Pass, '84, 1229, 1231.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Maj. Damrell, '84, 1228.

DAVIS ISLAND DAM. (See OHIO RIVER.)

DEAL'S ISLAND, MD. Upper thoroughfare between island and mainland—IMPROVEMENT OF.

Appropriations.

1882..... \$5,000, '82, 855.

Commerce.

Commercial statistics, '82, 855; '86, 870.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 150; '82, 138; '84, 145; '85, 139; '86, 132; '87, 96.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1882-'84. Reports, '82, 855; '83, 679; '84, 903.

W. F. Smith, U. S. Agent, 1884-'— Reports, '85, 889; '86, 870; '87, 846.

ASSISTANT.

G. W. Parsons. Report, '82, 856.

Projects.

By Lieut. Col. Craighill, 1882, to provide a harbor of refuge for small vessels and a landing place for steamers by dredging an anchorage basin with an approach from deep water and the construction of a breakwater to protect the dredged channel from filling. Estimated cost, \$20,000, '82, 856; '83, 686.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Lieut. Col. Craighill, '82, 856.

DEAL'S ISLAND, MD. Lower thoroughfare between Deal's and Little Deal's Island—IMPROVEMENT OF.

Appropriations.

1881..... \$5,000, '81, 884.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 111; '81, 138, 150; '82, 133; '83, 138.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1879-'83. Reports, '81, 882; '82, 883; '83, 679.

ASSISTANT.

G. W. Parsons. Report, '81, 883.

Contracts.

D. Constantine, for dredging, at 27 cents per cubic yard, '81, 884.

Operations.

1881-'82. 16,561 cubic yards material dredged, '82, 854.

1882-'83. No operations, '83, 679.

Plans.

By Lieut. Col. Craighill, 1881, for protection of channel near its mouth by riprap dike. Estimated cost from \$15,000 to \$20,000, '81, 883.

Projects.

By Lieut. Col. Craighill, 1881, for excavation of channel 100 feet wide and 7 feet deep at mean low water, from Tangier Sound, by the wharves of Daniel and of Vetra & Son, with turning basin at upper end. Estimated cost, \$10,000, '81, 882.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Craighill, '81, 883.

DEAL TO SEABRIGHT—EXAMINATION FOR BREAKWATER AT HARBOR OF LONG BRANCH, N. J.

(See LONG BRANCH HARBOR, N. J.—EXAMINATION OF COAST FROM DEAL TO SEABRIGHT FOR BREAKWATER AT.)

DEER CREEK, MISS.—EXAMINATION OF.**Commerce.**

Justification of improvement, '85, 1539.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85 244.

ENGINEER IN CHARGE.

Capt. E. Bergland. Report, '85, 1538.

ASSISTANT.

F. S. Burrows. Report, '85, 1540.

Obstructions.

Railroad and highway bridges without draws, '85, 1539, 1543.

Physical Characteristics.

Locality described, '85, 1538, 1540.

Plans.

In 1884 Capt. Bergland considered the stream worthy of improvement if the artificial obstructions were removed, and estimated that the creek could be cleared of logs and similar obstructions at a cost of \$13,563, '85, 1539, 1544.

Surveys.

Examination ordered by act of July 5, 1884. Made under the direction of Capt. Bergland, '85, 1538.

DEER RIVER, NORTH FORKED, TENN.—IMPROVEMENT OF.

[\$4,500 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213; '87, 203.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1880. Report, '81, 1492.

Capt. J. H. Willard. Report, '87, 1484, 1494.

ASSISTANT.

Z. Harrison. Report, '81, 1493.

Plans.

By Maj. Benyaard, 1880, for improvement of river from South Fork to Obion, a distance of 24 miles, by removal of snags, trees, and similar obstructions, and construction of wing-dams. Estimated cost, \$15,415.75, '81, 1496.

In 1887 Capt. Willard considered the river worthy of improvement by the removal of obstructions at an estimated cost of \$20,000, '87, 1484, 1494.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Benyaard, '81, 1492.

Examination below Dyersburgh, Tenn., ordered by act of August 5, 1886. Made under direction of Capt. Willard, '87, 1494.

DEER RIVER, SOUTH FORKED, TENN.—IMPROVEMENT OF.**Appropriations.**

1882.....	\$3,000, '83, 1155.
1884.....	2,000, '84, 1338.
1886.....	5,000, '86, 1368.
1888.....	2,500, act of August 11, 1888

Statement of appropriations, '87, 1485.

Encroachments.

Obstructions to navigation from bridges and dams, '87, 1483.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213; '83, 216; '84, 226; '85, 242; '86, 237; '87, 202.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1880-'83. Report, '81, 1489.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1154; '84, 1338.

Capt. E. Bergland, 1885-'86. Reports, '85, 1529; '86, 1367.

Capt. J. H. Willard, 1886-'— . Report, '87, 1482.

DEER RIVER, SOUTH FORKED, TENN.—Continued.**Engineers—Continued.****ASSISTANTS.**

Z. Harrison. Report, '81, 1490.

J. J. Barry. Reports, '84, 1339; '85, 1531.

Operations.

1883-'84. 17,915 logs, snags, stumps, and trees removed from river channel, '84, 1338.

1884-'85. 6,408 trees, logs, snags, etc., removed, '85, 1530.

1885-'86. No operations for lack of funds, '86, 1367.

1886-'87. 12,250 trees, logs, snags, and jams removed, '87, 1482.

Physical Characteristics.

Description of river, '84, 1339.

Projects.

By Maj. Benyaard, 1880, for removal of snags and similar obstructions and clearing banks of South Fork from Sharon to the mouth, a distance of 114 miles. Estimated cost, \$19,250, '81, 1491; '87, 202.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Benyaard, '81, 1489.

DELAWARE BAY TO CHINCOTEAGUE BAY. (See CHINCOTEAGUE BAY TO DELAWARE BAY—INLAND NAVIGATION BETWEEN.)**DELAWARE BAY, Ice-Harbor at head of—SURVEY OF.****Appropriations.**

1882. \$25,000, '82, 787.

Contracts.

1883. American Dredging Company, for removal of ice-piers at Reedy Island, '83, 619.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 93, 98; '81, 129; '82, 125; '83, 119; '84, 129; '85, 121; '86, 118; '87, 80.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1880-'82. Report, '80, 611.

Capt. W. Ludlow, 1882-'83. Report, '82, 784.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 618.

Maj. W. H. Heuer, 1884-'85. Reports, '84, 817; '85, 841.

Lieut. Col. H. M. Robert, 1885-'— . Reports, '85, 840; '86, 834; '87, 804.

ASSISTANT.

A. Stierle. Reports, '83, 619; '84, 817; '85, 842.

Physical Characteristics.

Tide-gauge observations at Port Penn and Liston's Point, from August 25 to October 19, 1883, '84, 823.

Borings, 1-'83, '84, 824; flood and ebb current surface velocities, 1883, '84, 825.

Plans.

By Capt. Ludlow, 1880, for an ice-harbor, protecting about 9 acres, near Liston's Bay; to consist of an iron substructure of screw piles carrying a wooden superstructure. Estimated cost from \$200,000 to \$250,000, '80, 613; '81, 847.

Plan modified in 1882 at an estimated cost of \$406,090.47, '82, 785, 787.

Consideration of plan of ice-harbor near Liston's Point, '84, 817-822; '85, 841-845. Estimated cost, \$308,800, '85, 845.

In 1885 Lieut. Col. Robert considered the plans hitherto proposed defective, and recommended that the matter remain for the present in abeyance, '85, 841; '86, 836. Suggesting a consideration of the use of an ice breaker of floating pontoons heavily anchored, in place of the previously proposed structures, '86, 836; '87, 804.

Surveys.

Ordered by act of June 14, 1880, '81, 846; '83, 619; '84, 817; '85, 842.

DELAWARE BREAKWATER, DEL.

(Continued from Vol. I, p. 169.)

Appropriations.

1882-79	\$2, 192, 103. 70
1882	125, 000. 00, '82, 792.
1884	75, 000. 00, '84, 845.
1886	56, 250. 00, '86, 840.
Total	2, 448, 353. 70
1888	100, 000. 00, act of August 11, 1888.

Contracts.

1882. Eppinger & Russel, for timber, '83, 658. S. R. Cummings, for creosoted timber, '83, 658. Finley, Garret & Wilson, for iron, '83, 658.
1883. W. H. Brown, for granite, at \$3.23 per ton, '83, 659. H. L. Fearing, for rope and cordage, '84, 845.
1884. A. J. Howell, for stone, at \$2.99 and \$2.77½ per cubic yard, '84, 846. C. A. Brown, for stone, at \$1.74 per ton, declined to enter into contract, '85, 847, 848. Andrews & Locke, for stone, at \$1.99 per ton, '85, 848.
1885. W. M. Field, for stone, at \$2.24 per ton, '86, 841.
1886. W. M. Field, for stone, at \$2.10 per ton, '87, 807.

Commerce.

1880. Number of vessels using harbor, '80, 610.
1881. Number of vessels using harbor, '81, 821.
1882. Number of vessels using harbor, '83, 659.
1883. Number of vessels using harbor, '84, 847.
1884. Number of vessels using harbor, '85, 847.
1885. Number of vessels using harbor, '86, 840.
1886. Number of vessels using harbor, '87, 807.
- Necessity for increased harbor area, '82, 792.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 97; '81, 127; '82, 125; '83, 129; '84, 137; '85, 122; '86, 119; '87, 81.

ENGINEERS IN CHARGE.

- Col. J. N. Macomb, 1877-'81. Reports, '80, 610; '81, 820.
- Capt. W. Ludlow, 1881-'82. Report, '82, 791.
- Lieut. Col. G. Weitzel, 1882-'84. Report, '83, 656.
- Maj. W. H. Heuer, 1884-'85. Report, '84, 845.
- Lieut. Col. H. M. Robert, 1885-'—. Reports, '85, 846; '86, 839; '87, 806.

ASSISTANTS.

- A. Stierle. Report, '81, 821.
- J. M. Stewart. Reports, '83, 659; '84, 846.

Operations.

- 1870-'82. Operations suspended, '70, 422; '76, i, 278; '79, 453; '83, 656.
- 1882-'83. Construction of derrick, scows, and delivery of brush and creosoted piles, '83, 659.
- 1883-'84. Construction of mattress foundation in progress; 7,500 tons granite received, '84, 846.
- 1884-'85. 258 mattresses, 1,813 cubic yards of small and 1,198 tons of large stone placed in foundation of work, and 3,000 tons of stone delivered in the gap, '85, 846.
- 1885-'86. 30,339 tons of stone placed in the gap, '86, 839.
- 1886-'87. 24,025 tons of stone placed in the gap, '87, 806.

Physical Characteristics.

- Ice formation in harbor, '81, 821.
- Changes of depth in harbor, '82, 791.
- Slopes of the breakwater, '86, 840.

Projects.

The original project was submitted in 1828 by a Board of Commissioners appointed by Congress, and proposed the construction, in the concavity of the bay just inside of Cape Henlopen, of two massive works on the pierres perdues or rip-rap system, separated by an interval of 1,390 feet; the larger work, called the breakwater, to afford safe anchorage during gales from the north and east, and the lesser, called the ice-breaker, to protect shipping against northeast gales and the heavy drifting ice in the bay, '79, 453; '86, 119.

This project was completed in 1869, under aggregate appropriations of \$2,192,103.70, and resulted in the construction of a breakwater 2,558 feet long and an ice-breaker 1,369 feet long on top, '79, 453; '86, 119, 840.

DELAWARE BREAKWATER, DEL.—Continued.**Projects—Continued.**

The Boards of Engineers of 1871 and 1879 recommended the closure of the interval between the breakwater and ice-breaker by a work similar to those already built, at an estimated cost of from \$600,000 to \$1,314,200, '72, 756; '79, 456.

In 1882 Capt. Ludlow proposed the closure of the gap by a random stone foundation carrying a concrete superstructure; the foundation to be brought to a height of 12 feet below mean low water, with a top width of 48 feet; the concrete superstructure to have a bottom width of 24 feet, a top width of 12 feet, and to rise 12 feet above mean low water. The estimated cost was \$675,000, '82, 792; '86, 119.

In 1883 a brush mattress foundation under the random stone superstructure was adopted, '83, 130, 659; '84, 845.

In 1884 the pile-bridge forming a part of the project of 1882 was abolished, '84, 846; '85, 122, 847; '87, 81.

Causes for probable increase in cost as originally estimated, '87, 806.

Surveys.

Ordered by act of March 3, 1881, '83, 130. Made under direction of Capt. Ludlow, '82, 792.

DELAWARE AND CHESAPEAKE BAY—CANAL BETWEEN.

(See CHESAPEAKE AND DELAWARE BAYS.)

DELAWARE RIVER—IMPROVEMENT OF, INCLUDING BETWEEN BRIDESBURG AND TRENTON, BELOW BRIDESBURG, AT SMITH'S ISLAND, AT SCHOONER LEDGE, AND AT CHERRY ISLAND FLATS.

(See also DELAWARE RIVER AT PHILADELPHIA.)

(Continued from Vol. I, p. 172.)

Appropriations.

1802-79	\$611,448.71
1860:	
Between Trenton and Whitehill	10,000.00, '80, 562.
Below Bridesburg	85,000.00, '80, 569.
At Schooner Ledge	40,000.00, '80, 578.
At Cherry Island Flats	100,000.00, '80, 580.
1881:	
Between Trenton and Bridesburg	10,000.00, '81, 735.
Below Bridesburg	100,000.00, '81, 745.
At Schooner Ledge	40,000.00, '81, 755.
At Cherry Island Flats	100,000.00, '81, 760.
1882:	
Between Trenton and Bridesburg	10,000.00, '82, 727.
Below Bridesburg	136,000.00, '82, 737.
At Schooner Ledge	40,000.00, '82, 742.
At Cherry Island Flats	100,000.00, '82, 745.
1884. Between Trenton and mouth	200,000.00, '85, 799.
1886. Between Trenton and mouth	210,000.00, '86, 808.
Total	1,792,448.71
1888	250,000.00, act of August 11, 1888.

Commerce.

List of vessels sunk in Delaware River and Bay, '81, 746.

Draught of vessels seeking port of Philadelphia, '85, 804.

Contracts.**BETWEEN TRENTON AND BRIDESBURG:**

1879. J. V. Patten, dredging, at 55 cents per cubic yard, '80, 563.

1880. M. Herron, dredging, at 22 cents per cubic yard, '81, 735.

1881. M. Herron, dredging, at 22 and 50 cents per cubic yard, '82, 728.

1882. M. Herron, dredging, at 40 and 50 cents per cubic yard, '83, 574.

DELAWARE RIVER—Continued.**Contracts—Continued.****BELOW BRIDGESBURG:**

1879. G. F. Ferris, dredging, at 26½ cents per cubic yard, '80, 570. F. B. Colton, dredging, at 27½ cents per cubic yard, '80, 570.
 1880. G. F. Ferris, dredging, at 35 cents per cubic yard, '80, 570. American Dredging Company, dredging, at 39 and 46 cents per cubic yard, '81, 747. F. Pidgeon, dredging, at 33 and 39 cents per cubic yard, '81, 747.
 1881. American Dredging Company, dredging, at 39, 41, and 58 cents per cubic yard, '82, 738. National Dredging Company, dredging, at 34½, 37, and 40 cents per cubic yard, '82, 738.
 1882. National Dredging Company, dredging, at 40 cents per cubic yard, '82, 738. Delaware and Chesapeake Improvement Company, dredging, at 37 cents per cubic yard, '83, 605. New York Steam Dredging Company, at 54½ cents per cubic yard, '83, 605. American Dredging Company, dredging, at 35 cents per cubic yard, '83, 605. New York Steam Dredging Company, dredging, at 38 cents per cubic yard, '83, 605. Delaware and Chesapeake Improvement Company, dredging, at 23½ cents per cubic yard, '84, 804.

AT SCHOONER LEDGE:

1880. Townsend & Trumbull, rock removal, at \$21 per cubic yard, '80, 578. American Dredging Company, rock removal, at \$17 per cubic yard, '81, 755.
 1881. American Dredging Company, rock removal, at \$24 per cubic yard, '82, 742.
 1882. American Dredging Company, rock removal, at \$21 per cubic yard, '83, 608.

AT CHERRY ISLAND FLATS.

1879. F. B. Colton, dredging, at 23 cents per cubic yard, '80, 580.
 1880. National Dredging Company, dredging, at 21½ cents per cubic yard, '81, 760.
 1881. National Dredging Company, dredging, at 21 cents per cubic yard, '82, 745.
 1882. National Dredging Company, dredging, at 23 cents per cubic yard, '83, 609.

BETWEEN TRENTON, N. J., AND THE MOUTH.

1885. American Dredging Company, for dredging west of Petty's Island, at 19½ cents per cubic yard, '86, 812. American Dredging Company, for dredging at Mifflin Bar, at 9½ cents per cubic yard, '86, 812. E. D. Register, for dike construction at Mifflin Bar, '86, 812. Failure to complete contract and its annulment, '86, 804. J. A. Bouker, for dike construction at Fisher's Point and Mifflin Bar, '86, 812. R. Patterson & Sons, for dike construction at Mifflin Bar, '86, 812.
 1886. R. W. Gibson, for construction of Smith's Island revetment, '87, 797. American Dredging Company, for dredging at Smith's Island Bar, at 18 cents per cubic yard, '87, 797. J. A. Bouker, for furnishing stone for Smith's Island revetment, at \$1.83 per cubic yard, '87, 797. American Dredging Company, for dredging west of Petty's Island, at 32 cents per cubic yard, '87, 797. J. H. Ward, for stone at Mifflin Bar Diike, at \$1.09 per cubic yard, '87, 797.
 1887. M. W. Locke, for dike construction at Reedy Island, '87, 797. Comparison of cost of dredging by contract and hired labor, '81, 757; '82, 734.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 91, 92, 93; '81, 116, 117, 118, 119; '82, 116, 117, 118, 119; '83, 112, 113, 114, 115, 116; '84, 122, 123, 124, 125, 126; '85, 115, 116, 117, 118, 119, 811; '86, 113, 114, 115, 825; '87, 76.

BOARD OF ENGINEERS.

- Constituted by S. O. No. 79, C. of E., 1879, to consider the improvement in progress at Bulkhead Shoals and Cherry Island Flats. Report, '80, 575. The Board approve of plans in progress, and recommend that dredged material be placed on the submerged lands adjacent to the channels dredged, '80, 567, 576.

(Col. Macomb, Lieut. Cois. Reynolds and Michler and Capt. Ludlow.)

- The Board of 1885, constituted by S. O. No. 117, C. of E., 1884, to examine and report upon the permanent improvement of the Delaware River and Bay, recommend the formation of a ship channel between Philadelphia and deep water in the bay not less than 600 feet wide and 26 feet deep at mean low water, '85, 822, 830.

(Lieut. Cois. Craighill and McFarland and Majs. Gillespie and Heuer.)

- Board reconvened October, 1885, to consider objections made by citizens of Camden to the construction of Fisher's Point dike. Report, '86, 822.

ENGINEERS IN CHARGE.

- Col. J. N. Macomb, 1877-'81. Reports, '80, 561, 563, 577, 579; '81, 733, 736, 752, 756.

Capt. W. Ludlow, 1881-'82. Report, '82, 725, 728, 740, 743.

Lieut. Col. G. Weitzel, 1882-'84. Report, '83, 594, 596, 607, 609.

Lieut. T. L. Casey, March 19 to April 19, 1884, '84, 792.

DELAWARE RIVER—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE—Continued.**

Maj. W. H. Heuer, 1884-'85. Reports, '84, 792, 794, 808, 809; '85, 802.

Lieut. Col. H. M. Robert, 1885-'— . Reports, '85, 798, 833, 834, 835, 836; '86, 801, 820, 826, 828, 829; '87, 786-799.

ASSISTANTS.

T. Valentine. Reports, '83, 601; '84, 802, 803, 809, 810; '85, 811.

A. Stierle. Reports, '83, 595, 598, 599; '84, 792, 797, 800; '85, 813.

J. J. Lee. Report, '83, 601, 602.

T. G. Locke. Report, '83, 608.

J. H. Dager. Report, '83, 610.

Lieut. T. L. Casey. Report, '85, 815.

E. A. Giesler. Report, '85, 817.

Legal Proceedings.

Injunction granted by State of New Jersey against construction of Fisher's Point dike, '86, 804, 806, 813, 815. Injunction removed by United States circuit court, '86, 807.

Operations.**BETWEEN TRENTON AND BORDENTOWN AND WHITEHILL.**

1879-'80. Closing of Duck and Long Island bar back channels with timber dikes filled with gravel, '80, 561; '81, 734. 12,760 cubic yards dredged from channels at Bordentown and Periwig Island, '80, 562.

1880-'81. 47,645 cubic yards dredged from channels at Bordentown; Duck and Long Island Bar dikes repaired, '81, 734.

1881-'82. 21,085 cubic yards dredged from channel at Bordentown, '82, 726.

1882-'83. Repairs to Duck and Long Island Bar dikes; 11,428 cubic yards dredged from channel at Bordentown, '83, 595.

1883-'84. 6,120 cubic yards dredged from channel at Bordentown, '84, 123, 793.

BELOW BRIDESBURG.

1879-'80. 48,132 cubic yards dredged from channel west of Petty's Island, opposite Port Richmond, '80, 564. 71,000 cubic yards dredged from Mifflin Bar, '80, 564. 5,000 cubic yards dredged from Bulkhead Shoals, '80, 565, 577.

1880-'81. Channel 75 feet wide and 9 feet deep dredged across upper end of Five-Mile Bar, '81, 736. 72,198 cubic yards dredged from channel west of Petty's Island, '81, 737. 10,000 cubic yards dredged from channel across upper end of Smith's Island Bar, '81, 737. 13,252 cubic yards dredged from Mifflin Bar, '81, 739.

1881-'82. 6,500 cubic yards dredged from channel at upper end of Petty's Island, '82, 729. 38,869 cubic yards dredged from channel at Port Richmond, '82, 730. 13,000 cubic yards dredged from channel across upper end of Smith's Island Bar, '82, 731. 22,000 cubic yards removed from Mifflin Bar, '82, 732. 40,000 cubic yards removed from Bulkhead Shoal, '82, 733.

1882-'83. 7,516 cubic yards removed from channel at Port Richmond, '83, 597, 598. 11,566 cubic yards removed from bar at upper end of Petty's Island, '83, 598. 135,194 cubic yards removed from Mifflin Bar, '83, 600. 67,119 cubic yards removed from Bulkhead Shoal, '83, 601.

1883-'84. 29,446 cubic yards removed from channel at Port Richmond, '84, 795. Aggregate of material removed at this point, 200,412 cubic yards, '84, 798. 23,394 cubic yards removed from Smith's Island Bar at upper end of island, '84, 801. 80,154 cubic yards removed from Mifflin Bar, '84, 802. 111,281 cubic yards removed from Bulkhead Shoal, '84, 803.

1884-'85. 16,372 cubic yards removed from Smith's Island Bar, '85, 834.

AT SHOONER LEDGE.

1879-'80. 1,386 cubic yards of rock and boulders and 2,309 cubic yards of sand and gravel removed, '80, 577.

1880-'81. 476 cubic yards of rock and boulders and 1,740 cubic yards of sand and gravel removed, '81, 753. Cost of rock removed, \$25.11 per cubic yard, '81, 754.

1881-'82. 1,886 cubic yards rock, 834 cubic yards boulders, and 3,867 cubic yards sand and gravel removed, '82, 741.

1882-'83. 1,481 cubic yards rock, 643 cubic yards boulders, and 3,566 cubic yards sand and gravel removed, '83, 608.

1883-'84. 288 cubic yards of rock removed, '84, 809.

1884-'86. No operations, '85, 835.

AT CHERRY ISLAND FLATS.

1879-'80. Commencement of operations; 300,000 cubic yards dredged from channel, '80, 579.

1880-'81. 405,374 cubic yards dredged from channel, '81, 757.

1881-'82. 409,342 cubic yards dredged from channel, '82, 743.

DELAWARE RIVER—Continued.**Operations—Continued.**

1882-'83. 338,423 cubic yards dredged from channel, '83, 610.

1883-'84. 141,601 cubic yards dredged from channel, '84, 810.

1884-'86. No operations, '85, 836.

FROM TRENTON, N. J., TO THE MOUTH.

1885-'86. Construction of gravel dike between Long Bar and Emily Islands, '86, 803. Construction of 3,500 linear feet of brush and stone dike at Fisher's Point, '86, 803. 91,194 cubic yards dredged from channel across upper end of Five-Mile Bar, '86, 805. 165,331 cubic yards dredged from main ship channel west of Petty's Island, '86, 805. 98,145 cubic yards dredged from channel across Mifflin Bar, '86, 806. Partial construction of 1,800 linear feet of dike at Mifflin Bar, '86, 804. Survey and tidal observations in progress, '86, 802.

1886-'87. 33,806 cubic yards dredged from channel across upper end of Five-Mile Bar, '87, 789. 60,019 cubic yards dredged from main ship channel west of Petty's Island, '87, 789. Construction of 1,100 linear feet of revetment, and the removal, by dredging, of 58,125 cubic yards in the formation of a channel across Smith's Island Bar, '87, 790. Partial construction of 7,200 linear feet of dike at Mifflin Bar, '87, 788. Commencement of dike from lower end of Reedy Island, '87, 789. Survey between Bridesburg and Trenton, and tidal observations at points below Philadelphia in progress, '87, 786, 787.

Physical Characteristics.

Law of increase of cross-sectional areas, '85, 817, 819.

Plans.

By Col. Weitzel, 1883, for the widening of the Pennsylvania channel opposite Petty's Island by the removal of a part of the west side of the island near its lower end, '84, 795. In 1884 Maj. Heuer submitted a report and estimate for the proposed work of \$1,010,460, '84, 796.

Projects.**BETWEEN TRENTON AND BRIDESBURG.**

The efforts of the past on this part of the river have been directed towards the improvement of the river between Trenton and Whitehill by dredging through the bar in the vicinity of Bordentown and Periwig shoal, so as to furnish navigable channels carrying 6 to 8 feet at mean low water, '84, 122; '85, 115, 803; '86, 113.

Plans for the comprehensive improvement of this part of the river not yet considered, '86, 113.

BELOW BRIDESBURG:

By Col. Weitzel, 1884, for the formation of a dredged channel across Smith's Island Bar, just above the island, 350 feet wide and 10 feet deep at mean low water, for the accommodation of the cross-river traffic, '84, 124, 800; '85, 805, 813, 814.

In 1885 Lieut. Col. Robert proposed the formation of a channel 200 feet wide and 10 feet deep across Smith's Island Bar in the vicinity of that executed under the previous project. To provide as far as possible against the refilling of the channel it was proposed to give it protection by a line of revetment placed on each side of the dredged channel and also oblique to the axis of the bar, so as to direct into it a part of the ebb tide. Estimated cost, \$40,000, '86, 806, 826; '87, 793, 794.

The projects prior to 1885 for the improvement of the river between Philadelphia and the bay have been directed towards the formation of channels 24 feet deep at mean low water across the bars below Philadelphia by means of dredging, except at Schooner Ledge, where solid rock was to be removed, '85, 115, 804; '86, 113.

The Board of Engineers of 1885 recommended the formation of a ship-channel from a point opposite Philadelphia and about midway between the American Ship-Building Company's yard and the Gas-Trust Wharf, to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel to be obtained, except at Schooner Ledge, where rock would require to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary as an aid to such contracting and regulating works. Estimated cost, \$2,425,000, '85, 802, 822, 830. The project for the improvement of the river between Trenton and Philadelphia to be submitted after completion of detailed surveys, '85, 799, 822; '86, 113.

Surveys.

Ordered by act of June 14, 1880, '80, 98. Made under direction of Col. Macomb, '79, 485; '81, 743.

Between Trenton and Bordentown, '83, 112.

In front of Philadelphia, '83, 599; '84, 799.

DELAWARE RIVER—Continued.**Surveys—Continued.**

Above Bridesburg, '85, 799; '86, 802; '87, 786.

MAPS.

At Petty's Island, '80, 564.

At Schooner Ledge, '80, 578.

DELAWARE RIVER AT PHILADELPHIA, PA.—IMPROVEMENT OF.

By the joint resolution of February 17, 1888, \$5,000 was appropriated for a survey of the river between the cities of Philadelphia and Camden, and the Secretary of War authorized to appoint a Board of Engineers to examine and report upon this part of the river.

The act of August 11, 1888, appropriated \$500,000 for the improvement of the harbor between the cities of Philadelphia, Pa., and Camden, N. J., by the removal of Smith's, Windmill, and Petty's islands, or such parts of them and the shoals adjacent thereto as may be required; provided that no part of this sum shall be expended until the title to the lands forming such islands shall be acquired and vested in the United States without charge to the latter beyond \$300,000 of the sum herein appropriated.

DES MOINES RAPIDS, Mississippi River—IMPROVEMENT OF AND OPERATION OF CANAL AND CONSTRUCTION OF DRY-DOCK AT.

(Continued from Vol. I, p. 175.)

Appropriations.

1856-79	\$4,646,700	
1880:		
For improvement of rapids	20,000	} '80, 177.
For operations of canal	30,000	
1881. Improvement of rapids	25,000	'81, 1737.
1882:		
Improvement of rapids	30,000	'82, 1778.
Construction of dry-dock	30,000	'82, 388.
1884:		
Improvement of rapids	50,000	'84, 1578.
Construction of dry-dock	30,000	'84, 1567.
1886:		
Improvement of rapids	26,250	'86, 1468.
Construction of dry-dock	48,750	'86, 1478.
Total	4,936,700	
1888:		
Improvement of rapids	35,000	} act of August 11, 1888.
Construction of dry-dock	16,250	
List of appropriations, '86, 1467, 1469; '87, 1641.		
Allotments for operation of canal, '86, 1469; '87, 1645, 1651.		

Commerce.

1880. Statement of commerce passing canal, '80, 1563.
 1881. Statement of commerce passing canal, '81, 1736.
 1882. Statement of commerce passing canal, '82, 1785.
 1883. Statement of commerce passing canal, '83, 1422.
 1884. Statement of commerce passing canal, '84, 1585.
 1885. Statement of commerce passing canal, '85, 1707.
 1886. Statement of commerce passing canal, '86, 1476.
 1887. Statement of commerce passing canal, '87, 1650.
 Regulations for use of canal, '85, 1701.

Contracts.

1881. With Tallant Marble Company, for riprap stone, at \$2.34 per cubic yard, '82, 1779.
 1882. With Patterson Brothers, for riprap stone, at \$3 per cubic yard, '82, 1779.
 1884. With Patterson Brothers, for furnishing stone, '85, 1696, 1708.
 1886. Patterson Brothers, for furnishing stone, '87, 1652.
 1887. Meacham & Wright for hydraulic cement, '87, 1652.

DES MOINES RAPIDS—Continued.

Engineers.**CHIEF OF ENGINEERS**

Reports, '80, 177; '81, 238; '82, 239, 233; '83, 239, 240; '84, 242, 243; '85, 263, 264; '86, 263, 264; '87, 219, 220, 221.

ENGINEERS IN CHARGE.

Maj. A. Stickney, 1878-'81. Reports, '80, 1555; '81, 1731.

Maj. A. Mackenzie, 1881-'—'. Reports, '82, 1777, 1781; '83, 1413, 1416, 1422; '84, 1576, 1580, 1586; '85, 1697, 1700, 1707; '86, 1466, 1468, 1477; '87, 1639, 1644, 1651.

ASSISTANT.

M. Meigs. Reports, '82, 1779, 1782; '83, 1415, 1419, 1423; '84, 1578, 1582, 1586; '85, 1690, 1704, 1708; '86, 1466, 1473, 1477; '87, 1642, 1648, 1652.

Legislation.

Relating to operation of canal, '81, 385.

Relating to construction of dry-dock, '82, 233, 388.

Relating to construction of pier, '85, 1697.

Operations.

1879-'80. 2,231 cubic yards rock removed from channel, '80, 1557. 39,336 cubic yards of mud removed from canal; lock grounds graded and riprap face wall built, '80, 1558, 1561. Operation of canal, '80, 1560.

1880-'81. 1,482 cubic yards rock removed from channel, '81, 1732. Two timber cribs placed at entrance to canal; 9,003 cubic yards mud removed from canal; grading lock grounds, '81, 1734. Provision for future operation of canal, '81, 385. Operation of canal, '81, 1734.

1881-'82. 1,332 cubic yards rock removed from channel, '82, 1777, 1780. 352 cubic yards stone placed for embankment protection, '82, 1777. 67,790 cubic yards mud removed from canal; repairs to canal embankment, '82, 1781, 1783.

1882-'83. 3,764 cubic yards rock removed from channel; 14,923 square yards riprap face stone laid in canal embankment; preparations made for raising lower lock walls; repairs to guiding cribs, '83, 1415. Repair of canal embankment, locks, and dredge; 100,000 cubic yards mud removed from canal, '83, 1419, 1420. Operation of canal, '83, 1416. Preparations for construction of dry-dock, '83, 1423.

1883-'84. 7,069 square yards riprap protection placed on canal embankment; east wing-wall at foot of canal raised; 2,380 cubic yards of rock and 26,067 cubic yards sand removed from channel, '84, 1577, 1579. 824 cubic yards of rock and 77,931 cubic yards sand removed from canal and approaches, '84, 1583. Repairs to dredge-boat and lock machinery, '84, 1584. Operation of canal, '84, 1580. Progress on dry-dock, '84, 1587, 1588.

1884-'85. 4,608 cubic yards riprap stone placed in canal embankment; west wing-wall at foot of canal raised; 1,814 cubic yards rock removed from channel, '85, 1699. 500 linear feet canal embankment repaired; 44,103 cubic yards of deposit dredged from canal and approaches, '85, 1704. Operation of canal, '85, 1700. Progress on dry-dock, '85, 1707.

1885-'86. 5,384 square yards riprap protection placed on canal embankment; 2 guiding-cribs placed above guard-lock, '86, 1465. 65,970 cubic yards of deposit removed from canal and approaches; repairs to lock machinery and dredges, '86, 1473, 1474. Operation of canal, '86, 1468. Progress on dry-dock, '86, 1477. Cost of dredging in canal, '86, 1474.

1886-'87. 1,353 square yards of slope wall laid on canal embankment; 1,313 cubic yards stone placed along foot of embankment; 209 cubic yards rock removed from Nashville Channel, '87, 1640, 1642. Operations and care of canal; 78,537 cubic yards dredged from canal; repairs to canal embankment, '87, 1644, 1648. Progress on construction of dry-dock, '87, 1651, 1652.

Projects.

The project of 1866 proposed the construction of a closed canal about 8 miles in length, reaching from Keokuk to Nashville, and an open canal through the rocky bed of the river for a distance of about 4 miles, from Nashville to Montrose. The depth of water to be obtained was from 5 to 6 feet, '67, 36, 264, 281, 337. See also index Vol. I, page 197.

The closed canal was so far completed in 1877 as to permit passage of boats and was opened to navigation on August 22, 1877, '78, 101, 739, 742. In 1880 it was proposed to raise the side walls of the middle lock and build two guiding-cribs at the guard-lock, '80, 1562; '84, 1577. In 1884 it was proposed to place two sluices opposite the largest creek to prevent silt being carried into the canal, '84, 1577; '86, 1467.

In 1882 Maj. Mackenzie proposed the construction of a dry-dock in connection with the canal 400 feet long, 100 feet wide, and located on the river side of the canal above the middle lock. Estimated cost, \$125,000, '83, 1422, 1423.

DES MOINES RAPIDS—Continued.**Projects—Continued.**

From 1856 to 1886 \$4,517,950 had been appropriated for the construction of the canal and channel through the rapids, \$360,500 for the maintenance and operation of the canal, and \$108,750 for the construction of a dry-dock, leaving the amount required to complete canal project \$101,745, and the dry-dock, \$16,350, '86, 1467, 1469, 1478.

DES PLAINES RIVER, ILL. (See ILLINOIS AND DES PLAINES RIVERS ILL.)**DETROIT RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 180.)

Appropriations.

1874-'79	\$175,000
1880.....	50,000, '80, 2081.
1881.....	50,000, '81, 2276.
1882.....	60,000, '82, 2374.
1884.....	200,000, '84, 2075.
1886.....	37,500, '86, 1844.

Total.....	572,500
1888.....	130,500, act of August 11, 1888.

List of appropriations from 1874-'80, '81, 2276.

Contracts.

1880. C. F. Dunbar, for rock removal, at \$7 and \$1 per cubic yard, '81, 2277.
 1881. C. F. Dunbar, for rock removal, at \$7 and \$1 per cubic yard, '82, 2374.
 1882. C. F. Dunbar, for rock removal, at \$7 and \$1 per cubic yard, '83, 1883.
 1884. Carlin, Stickney & Cram, for rock removal, at \$5.40 and \$1 per cubic yard, '85, 2168.
 1886. Dunbar & Sullivan, for rock removal, at \$6 and \$1 per cubic yard, '87, 2269.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 222; '81, 303; '82, 297; '83, 305, 1885; '84, 307; '85, 331; '86, 326; '87, 226.

ENGINEERS IN CHARGE.

Maj. G. Weitzel, 1874-'83. Reports, '80, 2080; '81, 2275; '82, 2373.

Maj. F. U. Farquhar, 1883. Report, '83, 1885.

Lieut. Col. O. M. Poe, 1883-'—. Reports, '83, 1882; '84, 2074; '85, 2165; '86, 1842; '87, 2266.

ASSISTANTS.

Capt. B. D. Greene. Report, '80, 2081.

H. A. Leavitt. Report, '80, 2080.

H. Kallman. Reports, '81, 2277; '82, 2374; '83, 1883; '84, 2076; '85, 2168.

Operations.

1879-'80. 12,121 cubic yards rock broken, 8,401 cubic yards rock removed by dredging, '80, 2082.

1880-'81. 5,065 cubic yards solid rock blasted, 10,775 cubic yards rock dredged, '81, 2277.

1881-'82. 10,270 cubic yards solid rock and 199 cubic yards loose rock removed, '82, 2374.

1882-'83. 7,190 cubic yards solid rock removed, '83, 1884.

1883-'84. 656 cubic yards solid rock removed, '84, 2076.

1884-'85. 8,369 cubic yards solid and 32 cubic yards loose rock removed, '85, 2166.

1885-'86. 15,140 cubic yards solid and 49 cubic yards loose rock removed, '86, 1843.

1886-'87. 14,544 cubic yards of solid and 144 cubic yards of loose rock removed from the straight channel; total amount of work done on the improvement, '87, 2267.

Plans.

By Lieut. Col. Poe, 1885, for increasing width of channel to 400 feet, at an additional cost of \$167,986, '85, 2166, 2167.

DETROIT RIVER, MICH.—Continued.**Projects.**

By Col. Weitzel, 1874, for improvement of Lime Kiln Crossing by excavation through the rock of a curved channel 300 feet wide and 20 feet deep. Estimated cost, \$1,166,500, '80, 222. Modified in 1883 by Maj. Farquhar to a straight channel of the same dimensions, at an additional cost of \$40,000, '83, 1885; '87, 2268. Reduction of ultimate cost of the work, '86, 326; '87, 2268.

In 1886 Col. Poe proposed increasing the width of the straight channel to 400 feet, at an estimated cost of \$163,000, '86, 1843; '87, 2268.

Surveys.**MAPS.**

'80, 2062; '81, 2278; '82, 2374; '83, 1882; '84, 2074; '85, 2168.

Lime Kiln Crossing, '86, 1843; '87, 2267.

DIVIDING CREEK, MD. EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 161.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '84, 962.

Capt. T. Turtle. Report, '84, 963.

ASSISTANT.

J. L. Seager. Report, '84, 963.

Plans.

In 1882 Lieut. Col. Craighill considered the creek worthy of improvement but did not consider the work a public necessity, '84, 962, 963.

Survey.

Examination ordered by act of August 2, 1882. Made under the direction of Lieut. Col. Craighill and Capt. Turtle, '84, 962, 963.

DOBOY BAR, GA.—IMPROVEMENT OF.**Appropriations.**

1886. \$10,000 from appropriation of \$20,000 for improving Altamaha River, '87, 1179.

Commerce.

Statistics of Darienport, '87, 1182.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 150, 154.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1886—'. Report, '87, 1179, 1199.

ASSISTANT.

Lieut. O. M. Carter. Report, '87, 1181-1200.

Physical Characteristics.

Description, '87, 1181-1200.

Projects.

By Col. Gillmore, 1887, for formation of a channel over the bar by propeller sluicing, '87, 1181.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Col. Gillmore, '87, 1199.

DOG ISLAND HARBOR, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 186.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1314.

DOG ISLAND HARBOR, FLA.—Continued.**Plans.**

In 1882 Capt. Damrell considered that the existing natural harbor needed no improvement, '82, 1314.

Surveys.

Ordered by act of March 3, 1881. Made under direction of Capt. Damrell, '82, 1314

DONALDSONVILLE, LA. (See BAYOU LA FORCHE, LA.)**DORCHEAT BAYOU, LA. (See BAYOU LOGGY, LAKE BISTENEAU, AND THE DORCHEAT, LA.)****DUBUQUE HARBOR, IOWA. (See MISSISSIPPI FROM SAINT PAUL TO DES MOINES RAPIDS.)****DUBUQUE, IOWA—ICE-HARBOR AT.**

(Continued from Vol. I, p. 183.)

Appropriations.

1844-'79	\$58,500
1882	20,000, '83, 1407.
1884	20,000, '85, 1693.

Commerce.

Necessity for ice-harbor, '82, 1769.

Use of harbor by vessels, '84, 1572.

Contracts.

1882. B. E. Linehan, for dredging, at 19½ cents per cubic yard, '83, 1407.

1884. A. J. Whitney, for dredging, at 11 cents per cubic yard, '85, 1694.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 230; '83, 237; '84, 240; '85, 262; '86, 252; '87, 222.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1880—. Reports, '82, 1769; '83, 1406; '84, 1571; '85, 1691; '86, 1426; '87, 1656.

Operations.

1882-'83. 55,733 cubic yards dredged, '83, 1407.

1883-'84. 37,062 cubic yards dredged, '84, 1571.

1884-'85. 70,770 cubic yards dredged, '85, 1693.

1885-'86. 45,927 cubic yards dredged, '86, 1426.

1886-'87. Operations suspended awaiting action of railroad company in filling areas contiguous to harbor, '87, 222.

Projects.

By Maj. Mackenzie, 1880, for the formation of an ice-harbor by the formation of a dredged basin at Waple's Cut, with an area of about 11 acres and a low-water depth of 6 feet. Estimated cost, \$40,000, '82, 1770, 1771. Area increased in 1884 to about 16 acres, '84, 1572; '87, 222.

Surveys.**MAP.**

'84, 1572.

DUCK CREEK, DEL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 184.)

Appropriations.

1880	\$5,000, '80, 590.
1881	3,000, '81, 788.
1882	2,000, '82, 772.
1888	10,000, act of August 11, 1888.
Statement of appropriations, '87, 831.	

DUCK CREEK, DEL.—Continued.**Commerce.**

Advantages of the improvement, '87, 849.

Contracts.

1881. F. Pidgeon, jr., for dredging, at 26½ cents per cubic yard, '81, 789.

1882. American Dredging Company, for dredging, at 25 cents per cubic yard, '82, 772.

1883. American Dredging Company, for dredging, at 24 cents per cubic yard, '83, 627.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 95; '81, 124; '82, 122; '83, 122; '84, 131; '85, 129; '86, 196; '87, 89, 97.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1878-'82. Reports, '80, 590; '81, 787.

Capt. W. Ludlow, 1882-'83. Report, '82, 772.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 627.

Maj. W. H. Heuer, 1884-'85. Report, '84, 830.

W. F. Smith, U. S. Agent, 1855-'— Reports, '85, 876; '86, 859; '87, 831, 847.

ASSISTANTS.

J. N. Odiorne. Report, '83, 628.

C. Humphreys. Report, '87, 848, 850.

Operations.

1880-'81. Excavation of channel 8 feet deep with a width of from 50 to 25 feet and a length of 600 feet, '81, 787.

1881-'82. No operations, '82, 772.

1882-'83. 7,196½ cubic yards material dredged, '83, 627.

1883-'87. No operations, '84, 830; '85, 876; '86, 859; '87, 831.

Plans.

By W. F. Smith, 1887, for the improvement of the channel over the bar at the river's mouth to a depth of 7 feet at low water by the construction of a jetty 2,000 feet long. Estimated cost, from \$20,000 to \$53,300, '87, 850.

Projects.

By Col. Macomb, 1879, for widening old "cut-off" and removing shoals by dredging. Estimated cost, \$12,000, '79, 471-473.

Revised, 1881, by Col. Macomb, for excavation of an 8-foot channel through the bar not less than 100 feet wide; also, for removal of shoals in the creek, making the entire cost of the project \$24,000, '81, 128, 788.

Surveys.

Made, 1880, under direction of Col. Macomb, '81, 787. Examination ordered by act of August 5, 1886. Made under direction of W. F. Smith, '87, 847, 850.

DUCK ISLAND HARBOR, CONN.—EXAMINATION FOR HARBOR OF REFUGE AT.**Commerce.**

No local commerce, '84, 684.

Necessity for harbor of refuge, '87, 642.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 99; '87, 56.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow. Report, '84, 684.

Lieut. Col. D. C. Houston. Report, '87, 641.

Plans.

By Maj. Barlow, 1882, for the formation of a small harbor of refuge by the construction of a breakwater from 1,200 to 1,800 yards in length, at an estimated cost of \$200,000, '84, 648. Modification proposed by Lieut. Col. Houston in 1886. Estimated cost, \$463,540, '87, 642.

Surveys.

Examination ordered by acts of August 2, 1882, and August 5, 1886. Made under the direction of Maj. Barlow, '84, 684, and under the direction of Lieut. Col. Houston, '87, 641.

DUCK RIVER, TENN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 184.)

Appropriations.

1890.....	\$7,000, '80, 1881.
1891.....	3,000, '81, 1868.
1892.....	3,000, '82, 1852.

Commerce.

Requirements of, fairly provided for by present improvement, '86, 1523.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 187, 190; '81, 253; '82, 247; '83, 255; '84, 255; '85, 277; '86, 269; '87, 233.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1879-'86. Reports, '80, 1681; '81, 1867; '82, 1851; '83, 1497; '84, 1651; '85, 1768.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1523; '87, 1757.

ASSISTANT.

D. L. Sniblett. Report, '80, 1682.

Operations.

1880-'81. Boats built and 55 snags and 1,281 trees removed by hired labor, '81, 1868.

1881-'82. 1,005 snags and trees cut out, 659 cubic yards excavated from channel, and 637 cubic yards rock quarried and placed in dams, '82, 1852.

1882-'83. 53 cubic yards of rock, 567 of gravel, and 1,637 of earth excavated from channel, 755 cubic yards stone quarried and placed in dams, and 1,174 trees and snags removed, '83, 1498.

1883-'87. No operations, '84, 1651; '85, 1768; '86, 1523; '87, 1757.

Physical Characteristics.

Condition of river, character of obstructions, etc., '80, 1683.

Projects.

By Maj. King, 1879, for the improvement of the river from its mouth to Centerville, a distance of 68 miles, by rock and gravel excavation, construction of wing-dams, and removal of snags and overhanging trees, so as to give a 3-foot navigation during six months of the year. Estimated cost, \$35,118, '80, 1684.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. King, '80, 1681.

DUGDEMONA RIVER, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 203.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887. Report, '87, 1489.

Plans.

Capt. Willard, 1887, reported that any improvement would be unadvisable and not a public necessity, '87, 1489.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Willard, '87, 1489.

DULUTH HARBOR, MINN.—IMPROVEMENT OF.

(See also SUPERIOR BAY, WIS.)

(Continued from Vol. I, p. 184.)

Appropriations.

1871-'79	\$261,049.20
1880.....	25,000.00, '80, 1876.
1881.....	40,000.00, '81, 2022.
1882.....	45,000.00, '82, 2096.

DULUTH HARBOR, MINN.—Continued.**Appropriations—Continued.**

1884.....	\$45,000.00, '84, 1813.
1886.....	56,250.00, '86, 1631.

Total.....	472,299.20
------------	------------

1888.....	80,000.00, act of August 11, 1888.
-----------	------------------------------------

Abstract of appropriations from 1871 to 1886 with method of expenditure, '80, 1876; '87, 1939.

Commerce.

Statistics, '80, 1877; '87, 1941.

Contracts.

1879. Williams & Upham, for dredging, at 14 cents per cubic yard, '80, 1877.
 1880. Williams & Upham, for dredging, at 16 cents per cubic yard, '81, 2022.
 1881. Williams & Upham, for dredging, at 14 cents per cubic yard, '81, 2022.
 1882. Williams & Upham, for dredging, at 16 cents per cubic yard, '83, 1616.
 1884. Williams & Upham, for dredging, at 14 cents per cubic yard, '85, 1940.
 1887. Williams, Upham & Co., for dredging, at 15½ cents per cubic yard, '87, 1940.
 C. S. Baker, for repairs to piers and placing buoys and construction of crib, '87, 1941.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 200; '81, 268; '82, 264; '83, 272; '84, 271; '85, 294; '86, 287; '87, 253.

BOARD OF ENGINEERS.

Convened at Duluth by S. O. No. 3, 1881. Report, '81, 2026. (Maj. Houston, and Capt. Mackenzie and Allen.)

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1878-'86. Reports, '80, 1875; '81, 2019; '82, 2095; '83, 1613; '84, 1809; '85, 1937; '86, 1627.

Capt. J. B. Quinn, 1886-'— Report, '87, 1935.

ASSISTANTS.

T. Shiels. Report, '80, 1878.

G. Wells. Reports, '82, 2098; '84, 1816.

Operations.

1879-'80. 168,508 cubic yards material dredged from inner harbor and area north of canal; repairs to piers; 150 linear feet revetment built at Wisconsin Point; 16,666 cubic yards material dredged from new cut, '80, 1879, 1880.

1880-'81. 113,158 cubic yards material dredged from inner harbor; repairs to south and old piers; 21,859 cubic yards material dredged from between piers, '81, 2020.

1881-'82. 194,169 cubic yards material dredged, of which 179,169 cubic yards were by contract; repairs to piers, '82, 2099, 2100.

1882-'83. 114,492 cubic yards material dredged; 1,170 linear feet decking laid on north and south piers, '83, 1614.

1883-'84. 91,832 cubic yards material dredged, '84, 1816, 1817.

1884-'85. Pier-head repaired; 173,102 cubic yards material dredged, '85, 1937, 1938.

1885-'86. 63,186 cubic yards material dredged; 51 cords stone riprap placed in south pier, '86, 1629.

1886-'87. No operations mentioned, '87, 1935-1941.

Projects.

By Maj. Farquhar, 1874, to afford by dredging a 16-foot anchorage in the harbor. Estimated cost, \$269,739.25, '74, 132; '80, 200.

By Board of Engineers, 1881, for maintenance of dredged areas, enlargement of harbor by dredging to accommodate vessels drawing 16 feet, and maintenance of piers bordering canal. Estimated cost, \$212,988.36, '81, 2026; '86, 1627.

Revised in 1884 by Maj. Allen, making total cost of above project \$305,424 '84, 1811; '86, 1628; '87, 1940.

Surveys.

Of harbor made, 1880, under direction of Capt. Allen, '80, 1876.

MAPS.

'82, 2102; '86, 1632; '87, 1944.

DUNKIRK HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 186.)

Appropriations.

1827-'79	\$430,946.43
1880.....	10,000.00, '80, 2192.

DUNKIRK HARBOR, N. Y.—Continued.**Appropriations—Continued.**

1884.....	\$10,000.00, '84, 2125.
1886.....	20,000.00, '86, 1876.

Total.....	470,946.43
1888.....	15,000.00, act of August 11, 1888.
List of appropriations from 1827 to 1880, '81, 2418.	

Contracts.

1881. G. W. White, for material and labor, '81, 2419. F. B. Gay, for iron, '81, 2419.
 1884. Hington & Woods, for dredging and breakwater repair, '83, 2248.
 1887. G. Elias & Brother, for timber, '87, 2349. D. McNaughton, for iron, '87, 2349.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 229; '81, 315; '82, 309; '83, 316; '84, 320; '85, 343; '86, 338; '87, 304.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1878-'83. Reports, '80, 2191; '81, 2417; '82, 2429.
 Capt. M. B. Adams, 1883-'84. Report, '83, 1927.
 Capt. E. Maguire, 1884-'85. Report, '84, 2124.
 Maj. L. C. Overman, 1885-'86. Reports, '85, 2246; '86, 1874.
 Capt. F. A. Mahan, 1886-'— . Report, '87, 2348.

Operations.

1879-'81. No operations for lack of funds, '80, 2192; '81, 2417.
 1881-'82. 150 linear feet of crib-work placed and superstructure commenced, '82, 2430.
 1882-'83. No operations for lack of funds, '83, 1928.
 1883-'84. No operations, '84, 2124.
 1884-'85. 13,318 cubic yards dredged for channel, 100 linear feet of face timbers removed, '85, 2246.
 1885-'86. 23,317 cubic yards material excavated, '86, 1875.
 1886-'87. Repairs to west breakwater, '87, 2348. History of work, '87, 2348.

Projects.

By Board of Engineers, 1870, for reconstruction of "dummy" crib as a day beacon, construction of 2,860 feet of breakwater and an east pier, also dredging and blasting in the channel to 13 feet. Estimated cost, \$350,000, '71, 216; '80, 229; '81, 315; '87, 2348.
 By Capt. M. B. Adams, 1883, for 860 linear feet of breakwater extension. Estimated cost, \$60,200, '83, 1928.

Surveys.**MAPS.**

'81, 2418; '84, 2124.

DUXBURY HARBOR, MASS.—EXAMINATION OF, '87, 31.**DWAMISH RIVER, WASH.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 342.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '84, 2296.

Physical Characteristics.

River described, '84, 2296.

Plans.

In 1883 Capt. Powell considered that the river was worthy of improvement though not a public necessity, '84, 2297.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Capt. Powell, '84, 2296.

EAGLE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 189.)

Appropriations.

1866-'79 \$97,000

Contracts.

1885. W. P. Raley, for removal of obstructions; unsatisfactory progress of contract, '85, 1970.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 202; '81, 272; '82, 267; '83, 275; '84, 274; '85, 297; '86, 291; '87, 257.

ENGINEERS IN CHARGE.

Lieut. Col. Henry M. Robert, 1871-'83. Reports, '80, 1900; '81, 2036; '82, 2115.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1632.

Lieut. Col. J. W. Barlow, 1884-'85. Reports, '84, 1828; '85, 1970.

Capt. C. E. L. B. Davis, 1885-'— . Reports, '86, 1641; '87, 1970.

Operations.

1879-'80. No operations, '80, 1900.

1880-'81. Stone filling put into guiding-cribs, '81, 272.

1881-'82. No operations, '82, 267.

1882-'83. Slight repairs made to guiding-cribs, '83, 275.

1883-'84. No operations, '84, 274.

1884-'85. Removal of bowlders from channel, '85, 1970.

1885-'86. Completion of removal of bowlders, '86, 1644.

1886-'87. No operations, '87, 1970.

Projects.

The project was completed in 1879 at a cost of \$93,000. As carried into effect it consisted in opening a channel 130 feet wide and 14 feet deep through the rocky reef obstructing the entrance to the harbor and defining the entrance through the reef by a guiding-crib on each side of the channel, '79, 1480; '87, 1970.

EAST BAY AND BLACKWATER RIVER, FLA.—EXAMINATION OF.

(See BLACKWATER AND EAST BAY, FLA.)

EAST CHESTER CREEK, N. Y.—IMPROVEMENT OF

(Continued from Vol. I, p. 191.)

Appropriations.

1873-'79 \$50,500

1880 3,500, '80, 513.

1886 10,000, '86, 664.

1888 5,000, act of August 11, 1888.

List of appropriations from 1873 to 1890, '81, 641:

Contracts.

1883. J. D. Flannery, for dredging, at 27 cents per cubic yard, '84, 730.

1887. Frank Pidgeon Dredging Company, for dredging, at 26 $\frac{1}{2}$ cents per cubic yard, '87, 630.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 83; '81, 102; '82, 103; '83, 102; '84, 107; '85, 98; '86, 91; '87, 53.

ENGINEERS IN CHARGE.

Col. J. Newton, 1878-'83. Reports, '80, 511; '81, 640; '82, 663.

Lieut. Col. G. L. Gillespie, 1883-'86. Reports, '83, 563; '84, 728; '85, 738.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 663; '87, 628.

Operations.

1883-'84. 18,236 cubic yards material dredged, '84, 729.

1884-'86. No operations for lack of funds; '85, 738; '86, 663.

1886-'87. Preparations for dredging in vicinity of Tower Dock; history of operations, '87, 629.

EAST CHESTER CREEK, N. Y.—Continued.**Projects.**

By Col. Newton, 1872, for providing, by dredging and rock removal, a channel 9 feet deep at high water from Pelham's Bridge to a point 3,000 feet above Lockwood's, a distance of 3 miles, that part of channel above Lockwood's to serve as channel and tidal basin. A modification of 1873 consisted of proposed timber dikes 5,800 feet in length to confine channel. Estimated cost, \$136,500, '72, 815; '73, 939; '77, 249; '86, 663.

In 1887 the estimate of cost was raised to \$221,100, '87, 628.

Surveys.

Examination of channel depths. Made, 1882, under direction of Col. Newton, '82, 663.

MAPS.

'86, 664.

EASTON POINT HARBOR, MD.—EXAMINATION OF.

(See also TREAD HAVEN CREEK, MD.)

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 137.

ENGINEER IN CHARGE.

W. F. Smith, U. S. Agent. Report, '85, 890.

ASSISTANT.

W. P. Smith. Report, '85, 890.

Plans.

In 1884 W. F. Smith considered that the improvement already made on Tread Haven Creek was all that was required at this locality, '85, 890.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of W. F. Smith, '85, 890.

EASTPORT, IOWA. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**EAST RIVER, N. Y.—EXAMINATION FOR THE REMOVAL OF LEDGES NEAR FOOT OF TENTH STREET.****Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 67.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland. Report, '87, 758.

Plans.

In 1887 Lieut. Col. McFarland considered that the removal of the ledge near the foot of Tenth street, New York, to the depth of 20 feet would cost about \$900,000, and that the cost was too great for the interests involved, '87, 759.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Col. McFarland, '87, 758.

EAST RIVER, N. Y.—IMPROVEMENT OF, AT HELL GATE.

(Continued from Vol. I, p. 192.)

Appropriations.

1852-'79	\$2,558,200
1880	200,000, '80, 499.
1881	200,000, '81, 624.
1882	250,000, '82, 649.

EAST RIVER, N. Y.—Continued.**Appropriations—Continued.**

1884.....	\$360,000, '84, 692
1886.....	112,500, '86, 676

Total 3,680,700

1898..... 250,000, act of August 11, 1888.

List of appropriations from 1868 to 1886, '86, 678; '87, 694.

Contracts.

1885. Rendrock Powder Company, for copper cartridge cases, 225,000 pounds rack-rock, '84, 719. R. W. Warren, for 50,000 pounds of dynamite, '85, 719. Atlantic Bredging Company, for rock removal at Flood Rock, at \$3.19 per ton, '86, 678.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 81; '81, 98; '82, 99; '83, 94; '84, 100; '85, 96; '86, 95; '87, 59.

ENGINEERS IN CHARGE.

Gen. J. Newton, 1866-'85. Reports, '80, 496; '81, 621; '82, 649; '83, 533; '84, 689; '85, 715; '86, 680.

Lieut. Col. W. McFarland, 1886—'. Reports, '86, 675; '87, 689.

ASSISTANTS.

Capt. J. Mercur. Reports, '80, 499; '84, 692.

R. Stone. Reports, '80, 503; '81, 627; '82, 653.

Lieut. G. McC. Derby. Reports, '82, 651; '83, 536; '85, 720, 724, 734.

Operations.

1879-'80. At Hallet's Point 15,195 tons of broken rock removed by contract. At Flood Rock 4,346 linear feet of galleries driven, removing 12,941 cubic yards of rock; removal of small rock near North Brothers Island; Diamond Reef removed to a depth of 26 feet; 2,596 cubic yards rock and bowlders removed from Frying Pan, Shell Drake, and Diamond reefs, '80, 496-505.

1880-'81. At Hallet's Point 9,824 tons of broken rock removed by contract. At Flood Rock 7,312 linear feet of galleries driven, removing 18,080 cubic yards of rock; 1,096 cubic yards rock removed from Heel Tap and North Brothers Reef, '81, 621-628.

1881-'82. At Hallet's Point 8,549 tons of broken rock removed by contract. At Flood Rock 6,453 linear feet of galleries driven, removing 21,690 cubic yards rock; 2,112 cubic yards rock removed from Heel Tap and North Brothers Reef, '82, 646-654.

1882-'83. Completion of rock removal at Hallet's Point. At Flood Rock 294 linear feet of galleries driven, removing 14,206 cubic yards of rock; 666 cubic yards rock removed from Pot Rock and Frying Pan, '83, 533-542.

1883-'84. Active operations suspended for lack of funds, '84, 689, 692.

1884-'85. At Flood Rock 1,488 linear feet of galleries driven, removing 9,819 cubic yards of rock, and completing all work preparatory to charging and exploding the mine, '85, 715-722. Removal of Pilgrim Rock to a depth of 24 feet, '85, 734. Experiments with explosives made, '85, 724.

1885-'86. Mine under Flood Rock fired October 10, 1885, '86, 675, 688. Details of charging and explosion, '86, 680. 558 tons of rock removed from channel at Negro Heads and Hen and Chickens; 28,622 tons of rock removed from Flood Rock by contract, '86, 676, 679, 688. Summary of work done from 1875 to 1886, '86, 690.

1886-'87. 34,956 cubic yards of rock removed in widening Newton Channel and in cutting away the northern end of Flood Rock, '87, 59, 691, 694. Details of cost of rock removal, '87, 691, 692.

Physical Characteristics.

Observations on transmission of earth waves at explosion of Flood Rock, '86, 691-717.

Projects.

In 1851-'52, under an appropriation of \$20,000, an effort was made to improve navigation through Hell Gate by the removal of rock through the aid of surface blasting, '68, 732. The project for the improvement of Hell Gate was proposed by Col. Newton in 1867. It was subsequently modified in 1868, 1874, 1880, and 1884 by extending it to embrace the removal of other reefs in the East River. It now includes the removal to a depth of 26 feet at mean low water of all the dangerous reefs in Hell Gate, Diamond Reef, and North Brothers Island Reef in the East River, the removal of Coenties Reef to 25½ feet and a number of small rocks in the shoaler parts of the channels; also the construction of seawalls on Great and Little Rocks, Hog's Back, and Holmes Rock. Estimated cost, \$5,139,120. '68, 741-745; '70, 437; '71, 725; '72, 803; '74, ii, 164; '76, i, 243; '80, 497; '84 680; '86, 95.

EAST RIVER, N. Y.—Continued.**Surveys.****MAPS.**

Progress sketch of Flood Rock, '80, 496; '81, 622; '82, 646; '83, 533; '85, 735.
Hell Gate and approaches, '85, 735; '86, 688.
Flood Rock, '86, 688.

ECHO HARBOR, NEW ROCHELLE, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 196.)

Appropriations.

1878-'79	\$13,000
1880	3,000, '80, 514.
1881	3,000, '81, 642.
1882	3,000, '82, 665.

Total..... 22,000

Statement of appropriations, '87, 685.

Contracts.

1881. G. W. Townsend, for removal of a part of Sheepshead Reef, '82, 686.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 83; '81, 103; '82, 104; '83, 97; '84, 104; '85, 89; '86, 89; '87, 52.

ENGINEERS IN CHARGE.

Col. J. Newton, 1875-'84. Reports, '80, 513; '81, 641; '82, 664; '83, 545.

Capt. J. Mercur, 1884-'85. Report, '84, 708.

Lieut. Col. W. McFarland, 1885-'86. Report, '85, 661.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 655; '87, 624.

Operations.

1879-'80. Removal of "Start Rock" completed, '80, 513.

1880-'81. No operations.

1881-'82. 506 cubic yards rock removed from Sheepshead Reef, '82, 665.

1882-'87. No operations, '83, 545; '84, 709; '85, 682; '86, 656; '87, 625.

Projects.

By Col. Newton, 1875, for removal of Sheepshead Reef and "Start Rock" to a depth of 9 and 6 feet, respectively. Modified in 1878 for removal of "Start Rock" to 7 feet depth. Estimated cost, \$38,955.38, '76, 264; '86, 656; '87, 624.

Surveys.**MAPS.**

'80, 513

EDENTON BAY AND HARBOR, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 196.)

Appropriations.

1878-'79	\$5,000
1884	10,000, '84, 1036.
1886	2,000, '86, 964.

Contracts.

1885. T. P. Morgan, for dredging, at 14 cents per cubic yard, '85, 1039.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 121; '84, 168, 177, 1074; '85, 159; '86, 154; '87, 122.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'80. Report, '80, 830.

Capt. F. A. Hinman, 1884-'— . Reports, '84, 1035, 1071; '85, 1038; '86, 963; '87, 989.

ASSISTANT.

G. H. Elliot. Report, '84, 1074.

Operations.

1879-'80. 3,260 cubic yards material dredged and 5 cypress stumps removed, '80, 830.

1884-'85. 29,000 cubic yards material dredged from channel and basin, '85, 1039.

EDENTON BAY AND HARBOR, N. C.—Continued.**Operations—Continued.**

1885-'86. 17,043 cubic yards material dredged from channel and basin, '86, 963.
 1886-'87. No operations and none required, '87, 989.

Projects.

By S. T. Abert, 1875, for improvement of Edenton Harbor and Bay by excavation of channel 850 yards long, 100 feet wide, and 9 feet deep; also a turning basin at the wharves. Estimated cost, \$12,650, '79, '80, 91, 696; 121.

From 1878-'84 \$5,000 was appropriated and expended on this project.

In 1883 Capt. Mercur proposed widening the channel to 150 feet at the outer and 200 feet at the inner end; also the completion of the turning basin with an area of about 12 acres, at an estimated cost of \$18,000, '84, 1073, 1074; '87, 122.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under direction of Capt. Mercur, '84, 1072.

MAPS.

'86, 964.

EDGARTOWN HARBOR AND SOUTH BEACH, MASS.—SURVEY OF.

(Continued from Vol. I, p. 197.)

Appropriations.

1826-'79 \$23,725.27

Commerce.

Justification of the improvement, '82, 578.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 89; '82, 89.

ENGINEER IN CHARGE.

Lieut. Col. G. K. Warren. Report, '82, 566.

Physical Characteristics.

Locality described, '82, 567.

Plans.

Various plans hitherto proposed, '82, 569.

By Col. Lieut. Warren, 1882, for the formation of a dredged channel through South Beach 300 feet wide and 6 feet at mean low water and the protection of the channel by a pile jetty on the west side of the channel. Estimated cost, \$39,000, '82, 578.

Surveys.

History of previous surveys, 82, 568.

Ordered by act of March 3, 1881. Made under the direction of Lieut. Col. Warren, '82, 566, 574.

EDISTO RIVER, S. C.—IMPROVEMENT OF.**Appropriations.**

1882..... \$8,000, '83, 889.
 1884..... 5,000, '84, 1094.
 1886..... 3,000, '86, 1084.
 1888..... 5,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

'80, 132; '81, 179; '83, 174; '84, 180; '85, 181, 191; '86, 179; '87, 143, 154.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1880-'—. Reports, '81, 1138; '83, 887; '84, 1092; '85, 1190; '86, 1082; '87, 1143.

ASSISTANTS.

Capt. J. C. Post. Report, '81, 1140.

Capt. T. M. Bailey. Reports, '83, 889; '84, 1094.

Lieut. F. V. Abbot. Reports, '85, 1192; '87, 1145.

Operations.

All operations by hired labor.

1882-'83. 77 snags, 124 piles, and 248 overhanging trees removed, '83, 888.

EDISTO RIVER, S. C.—Continued.**Operations—Continued.**

- 1883-'84. 40 piles, 57 snags, and 101 overhanging trees removed, '84, 1093.
 1884-'85. 5,796 overhanging trees cut down, 4,942 snags removed, and banks trimmed, '85, 1191.
 1885-'86. No operations, '86, 1062.
 1886-'87. 5,131 trees, logs, stumps, and snags removed, 5 outlets closed, and 1 cut-off cleared, '87, 1144, 1145.

Physical Characteristics.

Geographical description, '81, 1138, 1141.

Projects.

By Col. Gillmore, 1880, for enlargement and clearance of channel, formation of new channels across necks of bends, shutting off lateral channels, removal of logs, snags, and pile obstructions; also removal of sand and clay shoals, and construction of deflecting jetty. Estimated cost, \$33,385, '81, 1140; '86, 180; '87, 1143.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Gillmore, '81, 1138.

Col. Gillmore charged by act of July 5, 1884, with preliminary examination of North Fork of Edisto River in counties of Orangeburgh and Lexington, '85, 191.
 Examination of North Fork of Edisto River ordered by act of August 5, 1886, '87, 154.

ELIZABETH RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 196.)

Appropriations.

1879.....	\$7,500
1880.....	7,500, '80, 545.
1881.....	4,000, '81, 707.
1882.....	8,000, '82, 698.

Total..... 27,000

Commerce.

Importance of improvement, '82, 698.

Contracts.

1879. E. G. Brown, for dredging, at 37 cents per cubic yard, '80, 545.
 1880. T. H. Benton, for dredging, at \$1.05 per cubic yard, '81, 707.
 1881. T. H. Benton, for dredging, at \$1.05 per cubic yard, '82, 698.
 1882. F. C. Somers, for dredging, at 63 cents per cubic yard, '83, 581.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 88; '81, 111; '82, 112; '83, 108; '84, 115; '85, 106; '86, 110; '87, 69.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'83. Reports, '80, 545; '81, 706.
 Lieut. Col. G. L. Gillespie, 1883-'86. Reports, '83, 581; '84, 748; '85, 754.
 Lieut. Col. W. McFarland, 1886. Report, '86, 755.
 Lieut. G. McC. Derby, 1886-'— . Report, '87, 768.

Operations.

- 1879-'80. 7-foot channel, 60 feet wide and 4,110 feet long, excavated, '80, 545.
 1880-'81. 9,200 cubic yards material dredged, '81, 706.
 1881-'82. 3,335 cubic yards material dredged, '82, 697.
 1882-'83. 4,142 cubic yards material dredged, '83, 581.
 1883-'84. 6,952 cubic yards material dredged, '84, 748.
 1884-'85. No operations; project completed according to present requirements of commerce, '85, 754.

History of operations, '86, 785.

1886-'87. No operations, '87, 768.

Projects.

By Col. Maccomb, 1879, for dredging channel 60 feet wide to a depth of 7 feet at mean high water, from the mouth to Broad Street Bridge, 2.7 miles, requiring the removal of 44,000 cubic yards of material. Estimated cost, \$25,530, '79, 67, 482, 483.

Estimate increased in 1881 by Lieut. Col. Michler to \$43,160 from increased cost of dredging, '81, 707; '87, 768.

ELK RIVER, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 200.)

Appropriations.

1874-'79	\$10,000
1880	10,000, '80, 623.
1881	5,000, '81, 855.
1882	6,500, '82, 841.

Total..... 31,500

Contracts.

1880. G. H. Ferris, for dredging, at 24 cents per cubic yard, '81, 855.
 1881. G. H. Ferris, for dredging, at 33½ cents per cubic yard, '81, 855.
 1883. G. W. Parsons, for dredging, at 31 cents per cubic yard, '83, 667.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 99; '81, 131; '82, 128; '83, 132; '84, 140; '85, 132.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1873-'85. Reports, '80, 622; '81, 853; '82, 840; '83, 666; '84, 889.

W. F. Smith, U. S. Agent, 1885-'— Report, '85, 863.

Operations.

- 1879-'80. 15,565 cubic yards material dredged, '80, 622.
 1880-'81. 22,557 cubic yards material dredged, '81, 854.
 1881-'82. 11,139 cubic yards material dredged, '82, 840.
 1882-'83. Old dike removed and bank sloped back, '83, 667.
 1883-'84. Work of dredging and removal of old pier-head continued, '84, 890.
 1884-'85. Dredging and pier removal completed, '85, 883, 884.

Projects.

By Lieut. Col. Craighill, 1873, for the formation of channels 6 feet deep at low water and 75 feet wide, by dredging and diking in the Big Elk from Cedar Point to Elkton, and in Little Elk as far as Burnett's Wharf. Estimated cost, \$36,000, '74, 15, 82, 83; '80, 622.

Amended to include 8-foot depth, dike renewal and crib removal, increasing the estimate to \$38,600, '81, 854, 855.

Surveys.

Resurvey made in 1883, '83, 667.

ELK RIVER, TENN. AND ALA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 279.

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '85, 1771

Plans.

In 1884 Maj. King considered that until the completion of the Muscle Shoals Canal, Tennessee River, the mouth of the Elk River would be inaccessible and therefore not worthy of improvement, '85, 1771.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. King, '85, 1771.

ELK RIVER, W. VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 200.)

Appropriations.

1875-'79	\$10,500
1880	5,000, '80, 691.
1881	5,000, '81, 917.
1882	2,000, '82, 931.
1886	1,500, '86, 1598.

Total..... 24,000

1888..... 3,000, act of August 11, 1888.

ELK RIVER, W. VA.—Continued.**Commerce.**

Obstructions to, arising from lock and dam at Charleston, '80, 692; '82, 931; '83, 716; '84, 937; '85, 1858; '86, 1599.

Encroachments.

River obstructed by mill-dams, '80, 692. Dilapidated condition of corporate lock and dam near Charleston makes it an obstruction to navigation, '82, 143, 931, 933; '83, 716; '84, 937.

Recommendation by officer in charge that all operations be suspended until this obstruction is remedied, '82, 934; '83, 716; '85, 1858.

Act of the State legislature providing for the removal of dams, '87, 1923.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 108; '81, 147; '82, 143; '83, 147; '84, 150; '85, 286; '86, 281; '87, 251.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1876.— Report, '80, 690; '81, 917; '82, 931; '83, 716; '84, 936; '85, 1857; '86, 1598; '87, 1923.

ASSISTANTS.

Lieut. T. Turtle. Report, '80, 692, 695.

Capt. E. H. Ruffner. Reports, '81, 917; '82, 931.

A. M. Scott. Reports, '84, 936; '85, 1858; '86, 1599.

Legal Proceedings.

Towards removal of obstructing lock and dam near Charleston, '84, 937; '85, 1856; '86, 1598.

Act of State legislature providing for removal of dams, '87, 1923.

Operations.

1879-'80. Removal of rocks, trees, and gravel bars, '80, 109, 693.

1880-'81. Removal of rock and construction of gravel and stone dikes at shoals, '81, 147, 917.

1881-'82. Formation of chutes and dikes at shoals, '82, 731.

1882-'83. Operations suspended awaiting action of corporate interests towards remedying obstruction from lock and dam at Charleston, '83, 716.

1883-'84. Removal of rocks from channel, '84, 936.

1884-'85. Removal of obstructions from channel, '85, 1858.

1885-'86. No operations for lack of funds, '86, 1598.

1886-'87. No operations, '87, 1923.

Projects.

By Maj. Craighill, 1875, for an improvement of channels through shoals to a depth of 10 or 12 inches at low water by cutting sluice-ways 12 feet wide; also the removal of rocks, snags, and overhanging trees. Estimated cost, \$100,000, '76, ii, 168, 171; '79, 555; '80, 691; '81, 147; '85, 286.

Injurious effect of corporate lock and dam at Charleston, '82, 932, 934; '83, 147; '85, 1858.

Act providing for its removal, '87, 1923.

EMPIRE BAY, MICH.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 221; '81, 301.

ENGINEER IN CHARGE.

Maj. F. Harwood, 1880. Report, '81, 2258.

Physical Characteristics.

Description of, '81, 2259.

Plans.

(1) By Maj. Harwood, 1881, for harbor at North Bar Lake, with channel of entrance 200 feet wide and 15 feet deep, to be accomplished by 1,800 linear feet pile and brush pier and dredging. Estimated cost, \$60,000, '81, 2260.

(2) Or for harbor at South Bar Lake, with channel of entrance 200 feet wide, with depth of 10 feet, to be accomplished by 1,400 linear feet pile and brush pier 20 feet wide and dredging. Estimated cost, \$42,000, '81, 2261.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Harwood, '81, 2258.

EMPIRE, LAKE MICHIGAN—WITH A VIEW TO CUTTING A CHANNEL ACROSS THE BAR FROM LAKE MICHIGAN TO BAR LAKE.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 286.

ENGINEER IN CHARGE.

Capt. D. W. Lockwood, 1887. Report, '87, 2209.

Physical Characteristics.

Description of present harbor at Empire, '87, 2210.

Plans.

Capt. Lockwood, 1887, considers the excavation of such a channel as purely local in importance and does not regard the locality as worthy of improvement, '87, 2210.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Lockwood, '87, 2211.

ENTRANCE TO CUMBERLAND SOUND, FLA. AND GA. (See CUMBERLAND SOUND, GA., IMPROVEMENT OF ENTRANCE.)

ERIE (PRESQUE ISLE) HARBOR, PA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 201.)

Appropriations.

1823-79	\$616,367.23
1880	25,000.00, '80, 2186.
1881	20,000.00, '81, 2334.
1882	20,000.00, '82, 2417.
1884	50,000.00, '84, 2122.
1886	37,500.00, '86, 1880.

Total	768,867.23	
1888 { Protection of Presque Isle		} act of August 11, 1888.
{ Peninsula	60,000.00	
{ Erie (Presque Isle) Har-		
{ bor, Pa.	23,000.00	

Statement of appropriations from 1823, with method of expenditure, '83, 1926.

Contracts.

1879. Hemenway & Hayes, for pier construction, '81, 2187; amended, '81, 2331. Cleveland, Brown & Co., for pier construction, '80, 2188. O. J. Jennings, for dredging, at 15 cents per cubic yard, '80, 2189.

1880. G. W. & A. F. McKenzie, for pile jetty construction, '80, 2188. H. H. Hine, for pier construction, '81, 2334; annulled, '81, 2331. H. B. Strong, for pier construction, '81, 2335. J. Barnett, for iron, '81, 2334. G. W. & A. F. McKenzie, for pier construction, '81, 2335.

1881. G. Talbot, for dredging, at 23 cents per cubic yard, '81, 2336.

1882. J. L. Linn, for removal and replacement of old superstructure, '82, 2418. J. L. Linn, for dredging, at 22½ cents per cubic yard, '82, 2418.

1886. J. Rooney, for dredging, at 26 cents per cubic yard, '87, 2346.

1887. D. McNaughton, for iron, '87, 2346. G. Elias & Brother, for timber, '87, 2346.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 228; '81, 313; '82, 308, 2420; '83, 316; '84, 319; '85, 344; '86, 339; '87, 304.

BOARD OF ENGINEERS.

Convened by S. O. No. 49, C. of E., 1882, '82, 2422. The Board did not consider the danger imminent of a break through the peninsula of Presque Isle, '82, 2422.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2172; '81, 2331; '82, 2414, 2422.

Capt. M. B. Adams, 1883-'84. Report, '83, 1923.

Capt. E. Maguire, 1884-'86. Reports, '84, 2120; '85, 2253; '86, 1879.

Capt. C. F. Palfrey, 1886. '87, 2343.

Capt. F. A. Mahan, 1886-'— Report, '87, 2343.

ERIE HARBOR, PA.—Continued.**Operations.**

History of the work, '80, 2172; '82, 2423.

1879-'80. 102,763 cubic yards sand dredged from channel; 10 snags removed, '80, 2182.

1880-'81. 160 linear feet crib-work placed in north pier and 150 linear feet on south pier; 455 linear feet superstructure rebuilt on south pier; 11,808 linear feet piling driven in spur-jetties; 2,000 linear feet brush and stone protection renewed, '82, 2332.

1881-'82. North pier extended 242 linear feet and riprapped with 1,200 tons large stone; strengthened by driving oak piles along 380 linear feet of channel face; south pier extended 423 linear feet; 25,000 cubic yards material dredged, '82, 2415.

1882-'83. 385 linear feet north pier superstructure rebuilt and 90 feet redecked; 18,000 cubic yards sand dredged; 193 piles driven for catch-sand jetty; pile protection at neck of peninsula completed, '83, 1924.

1883-'84. Extension of jetty at eastern end of peninsula, '84, 2121.

1884-'85. Minor repairs to north pier and south breakwater, '85, 2253.

1885-'86. No operations, '86, 1879.

1886-'87. Dredging between and in front of piers, '87, 304, 2344.

Physical Characteristics.

Retrograde movement of shore-line, '82, 2420, 2423.

Projects.

Projects for this improvement from its inception in 1823 have been directed to the formation of a harbor in Presque Isle Bay with a protected channel across the entrance to the bay. The aggregate appropriations, including 1886, have been \$768,867.23.

In 1886 Capt. Maguire estimated that \$84,120 would be required to extend the pier to the 16-foot curve and maintain a channel 16 feet deep between the harbor and deep water in the lake, '86, 339.

Surveys.

Beach line surveyed, '80, 2184.

Examination of harbor, 1881, '81, 2332.

Examination of outer beach of peninsula, 1881, '81, 2333.

Survey of peninsula, '85, 2253.

MAPS.

'81, 2338; '84, 2122.

ESCAMBIA AND CONECH RIVERS, ALA. AND FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 204.)

Appropriations.

1883-'86 \$10,500

1880. Escambia 8,000, '80, 1082.

1881. Escambia 5,000, '81, 1199.

1882. Escambia and Conecuh 12,000, '82, 1278.

1884:

Escambia 3,000, '84, 1198.

Conecuh 12,000, '84, 1200.

1886. Escambia and Conecuh 12,000, '86, 1176.

Total 62,500

1888 10,000, act of August 11, 1888.

Contracts.

1881. W. A. Alexander, for dredging, at 47½ cents per cubic yard, '81, 1290.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 137; '81, 185; '82, 182; '83, 194; '84, 202; '85, 205; '86, 203; '87, 165.

ENGINEERS IN CHARGE.

Maj. A. N. Damreth, 1878-'85. Reports, '80, 1082; '81, 1198; '82, 1277; '83, 1006, 1007; '84, 1197.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1309; '86, 1175; '87, 1273.

Operations.

1881-'82. Channel 3,240 feet long, 100 feet wide, and 5½ feet deep at mean low water dredged through the bar (Escambia), '82, 1277.

1882-'83. 1,216 trees, snags, and stumps removed (Conecuh), '83, 1007.

ESCAMBIA AND CONECUH RIVERS, ALA. AND FLA.—Con'td.**Operations—Continued.**

1883-'84. Snags, trees, and obstructions removed throughout 85 miles of river (Escambia), '84, 1198. Obstructions removed from 33 miles of river (Conecuh), '84, 1199.

1884-'85. 15,472 snags and trees removed (Conecuh), '85, 1310.

1885-'86. 10,943 logs, snags, and trees, and 105 cubic yards rock removed from Conecuh and Escambia rivers, '86, 1175.

1886-'87. 2,569 trees, logs, and stumps, and 45 cubic yards of rock removed from channel, '87, 1274.

Projects.

By Capt. Damrell, 1879, for the improvement of the Escambia River from mouth to State line, by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, the removal of snags and similar obstructions, and by shore protection and wing-dam construction to obtain a 5-foot low-water channel throughout the length of the river. Estimated cost, \$25,000, '79, 853, 856; '80, 1082.

In 1882 \$12,000 was appropriated for the Escambia and Conecuh rivers, when it was proposed to extend navigation to Indian Creek, 273 miles above the mouth of the river, by removal of obstructions, closing cut-off, and rock removal, at an additional estimated cost of \$62,430 over the estimate of 1879, '83, 1007; '87, 1273.

Surveys.**MAPS.**

'84, 1198.

ETOWAH RIVER, GA.—IMPROVEMENT OF

(Continued from Vol. I, p. 265.)

Appropriations.

1876-'79 \$10,000

Commerce.

Cost of improvement greater than would be justified by the advantages to be derived, '80, 1693.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 189; '81, 256; '82, 250.

ENGINEER IN CHARGE.

Maj. W. R. King, 1879-'82. Reports, '80, 1693, 1694; '81, 1874; '82, 1858.

ASSISTANTS.

Lieut. W. L. Marshall. Report, '80, 1694.

E. Ruhl. Report, '80, 1695.

Legislation.

Transfer made by act of August 2, 1882, of balance (\$8,700) remaining from Etowah River appropriation of 1876 to Coosa River improvement, '82, 1858.

Physical Characteristics.

Description of river, '80, 1694.

Plans.

By Maj. King, 1879, for improvement of 63 miles of river, giving a navigable channel 4 feet deep, by construction of 27 locks and dams. Estimated cost, \$2,276,663, '80, 1698. Improvement not considered justifiable, '80, 1693.

Surveys.

Ordered by act of June 18, 1878. Made, 1879, under direction of Maj. King, '80, 1694.

EXETER RIVER, N. H.—IMPROVEMENT OF.

(Continued from Vol. I, p. 266.)

Appropriations.

1880 \$20,000, '80, 343.

1881 15,000, '81, 497.

Contracts.

1881, T. Symonds, for dredging, at \$1.06, and 46 cents, and 47 cents per cubic yard, '81, 498.

EXETER RIVER, N. H.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 68; '81, 70; '82, 70.

ENGINEER IN CHARGE.

Col. G. Thom, 1875-'82. Reports, '80, 342; '81, 496; '82, 504.

Legislation.

Purchase of right of way for projected cut-off at the Ox-Bow, '81, 497.

Operations.

1880-'81. 47,000 cubic yards material dredged and sunken wrecks removed by hired labor, completing projected improvement, '81, 497.

Projects.

By Col. Thom, 1875, for a channel 40 feet wide and 12 feet deep at mean high water to Ox-Bow, and thence (with 10-foot depth at mean high water and the same width), by a cut-off through Ox-Bow, to upper wharves at Exeter, by dredging and removal of bowlders. Estimated cost, \$34,000, '75, ii, 437, 439, 430; '81, 496.

FAIRLEE CREEK, MD.—SURVEY OF.

[\$5,000 appropriated by act of August 11, 1886.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 97.

ENGINEER IN CHARGE.

W. F. Smith, U. S. Agent, 1886. Report, '87, 854.

ASSISTANT.

C. Humphreys. Report, '87, 854.

Physical Characteristics.

Description of the creek, '87, 855.

Plans.

By W. F. Smith, 1887, for excavation of a channel across the bar at mouth of creek 7 feet deep and 100 feet wide. Estimated cost, \$15,450, '87, 856.

Surveys.

Ordered by act of August 5, 1886. Made, 1887, under direction of W. F. Smith, '87, 855.

FAIRPORT HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 206.)

Appropriations.

1825-'79	\$229, 123. 53
1880	3, 000. 00, '80, 2154.
1881	10, 000. 00, '81, 2321.
1882	10, 000. 00, '82, 2408.
1884	10, 000. 00, '84, 2109.
1886	18, 750. 00, '86, 1870.

Total 280, 873. 53

1888 10, 000, act of August 11, 1886.

Contracts.

1881. D. M. Averill, for pier repairs, '81, 2321.

1882. E. H. French, for dredging, at 27 cents per cubic yard, '82, 2409.

1882. J. Bennett, for iron, '83, 1915. C. T. Dennis, for pier extension, '83, 1914.

1885. W. E. Rooney, for dredging, at 23½ cents per cubic yard, '85, 2236. C. D. Merry, for pier extension and repairs, '85, 2236.

1886. W. J. Starkweather, for dredging, at 28 cents per cubic yard, '87, 2324. L.

P. Smith, for repair to piers, '87, 2324.

1887. Kerr, Stang & Gillmore, for pier extension, '87, 2324.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 227; '81, 311; '82, 306; '83, 313; '84, 317; '85, 341; '86, 336; '87, 302.

FAIRPORT HARBOR, OHIO—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2147; '81, 2320; '82, 2407.

Maj. L. C. Overman, 1881— Reports, '83, 1914; '84, 2108; '85, 2235; '86, 1868; '87, 2324.

Operations.

History of operations, '80, 2147; '86, 336.

1879-'80. 575 linear feet east pier superstructure rebuilt, 6,975 cubic yards material dredged from bar, and repairs to piers, '80, 2153.

1880-'81. No operations, '81, 2320.

1881-'82. 376 linear feet east pier superstructure rebuilt and extensive repairs made; 10,000 cubic yards material dredged from channel through bar, '82, 2407.

1882-'83. Four cribs completed, '83, 1914.

1883-'84. West pier extended 160 feet and settled part rebuilt; minor repairs to east pier, '84, 2109.

1884-'85. 10,082 cubic yards material dredged, '85, 2236.

1885-'86. East pier extended 80 feet, west pier superstructure repaired, '86, 1869.

1886-'87. 4,930 cubic yards dredged from channel through bar and between the piers; repairs made to piers; extension of east pier in progress, '87, 2324.

Private and Corporate Work.

Dredging by Painesville and Youngstown Railroad Company, '80, 2153.

Projects.

By Capt. Maurice, 1825, for removal of bar at mouth of river by construction of parallel piers 200 feet apart, extending out to a depth of 10 feet, the west pier to be longer than the east and to flare to the westward. Estimated cost, \$6,997.81, '80, 2147.

For extensions and changes in original project see history of work, '80, 2147.

In 1879 the west pier had reached a total length of about 1,060 feet and the east pier 1,250 feet, '81, 2320.

By Maj. Wilson, 1880, for extension of west pier 500 feet and east pier 600 feet, renewal of superstructure, and dredging in channel to maintain a depth of 15 feet at harbor entrance. Estimated cost, \$80,300, '80, 2153. Increased in 1882 to \$93,000, '82, 2407; '87, 2325.

Surveys.

Examination of harbor, 1881, '81, 2320. Survey of harbor, 1882, '82, 2407.

MAPS.

'81, 2320.

FALKNER'S ISLAND, CONN.—EXAMINATION FOR BREAKWATER AT.**Commerce.**

Necessity for harbor of refuge at, '85, 708.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 96.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland. Report, '85, 707.

Physical Characteristics.

Locality described, '85, 707.

Plans.

By Lieut. Col. McFarland, 1884, for the construction of two breakwaters, each about 600 yards long, covering an anchorage area of 120 acres, with a depth of 15 feet. Estimated cost, \$700,000, '85, 703, 709.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. McFarland, '85, 707.

FALLS OF THE OHIO RIVER—IMPROVEMENT OF NAVIGATION AT.

(See OHIO RIVER, FALLS OF.)

FALLS OF SAINT ANTHONY, Mississippi River. (See MISSISSIPPI RIVER, PRESERVATION OF THE FALLS OF SAINT ANTHONY.)

FALMOUTH HARBOR, MASS.—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 43.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1886. Report, '87, 567.

Physical Characteristics.

Description, '87, 567.

Plans.

Maj. Livermore, 1886, reports that he does not consider the improvement justified by its prospective benefit to commerce, '87, 568.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Livermore, '87, 567.

FAWN CREEK, ILL.—EXAMINATION OF, WITH A VIEW TO CHANGING THE COURSE OF THE SAME.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 277.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1886. Report, '87, 2171.

Physical Characteristics.

Description, '87, 2171.

Plans.

Maj. Handbury, 1886, reports the improvement as not called for by the necessities of commerce, '87, 2171.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Handbury, '87, 2171.

FEATHER RIVER, CAL. (See SACRAMENTO AND FEATHER RIVERS.)

FERNANDINA AND SAINT JOHN'S RIVERS, FLA. (See SAINT JOHN'S AND FERNANDINA RIVERS.)

FINHALLOWAY RIVER, FLA.—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 141; '81, 189; '82, 186.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1301.

ASSISTANT.

P. Robinson. Report, '82, 1301.

Plans.

By Capt. Damrell, 1881, for improvement from the mouth to head of Dead River, a distance of 12 miles, by removal of such snags and trees as may interfere with rafting logs. Estimated cost, \$500, '82, 1302.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Damrell, '82, 1301.

FISH-WAYS AT GREAT FALLS OF POTOMAC RIVER. (See POTOMAC RIVER, FISH-WAYS AT.)

FIVE-MILE RIVER HARBOR, CONN.—EXAMINATION OF.

[§5,000 appropriated by act of August 11, 1888.]

Commerce.

Present and prospective, '87, 640, 641.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 56.

ENGINEER IN CHARGE.

Lieut. Col. D. C. Houston, 1886-'— Report, '87, 639.

Physical Characteristics.

Description of the harbor, '87, 639.

Plans.

By Lieut. Col. Houston, 1886, for deepening the harbor and approaches by a channel 100 feet wide, 8 feet deep at mean low water, and 6,000 feet long. Estimated first cost, \$25,000, with \$1,000 for annual maintenance, '87, 641.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Houston, '87, 639.

FLINT RIVER, GA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 208.)

Appropriations.

1878-'79	\$17,000
1880	20,000, '80, 1075.
1881	15,000, '81, 1188.
1882	25,000, '82, 1263.
1884	20,000, '84, 1173.
1886	20,000, '86, 1164.

Total 117,000

1888 20,000, act of August 11, 1888.

List of appropriations previous to 1880, '80, 1073.

Commerce.

Justification of improvement, '83, 977.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 134; '81, 182; '82, 178; '83, 188; '84, 196; '85, 201; '86, 199; '87, 167, 171.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1873-'85. Reports, '80, 1073; '81, 1186; '82, 1261; '83, 975; '84, 1170.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1298; '86, 1162; '87, 1278, 1290.

ASSISTANT.

P. M. Slaughter. Report, '87, 1290.

Operations.

1879-'80. 1,282 cubic yards rock and 103 snags removed; 2 barges built and 1 repaired, '80, 1074.

1880-'81. 390 linear feet of dam built; 2,393 cubic yards rock removed, '81, 1187.

1881-'82. 2,627 cubic yards rock removed; 350 linear feet stone dam built; 3,460 snags and trees cut and removed, '82, 1262.

1882-'83. 4,821 trees and snags removed; 2,439 cubic yards rock removed, '83, 976.

1883-'84. 2,392 snags removed; 2,954 cubic yards rock removed, '84, 1171.

1884-'85. 12,961 snags and 2,202 cubic yards rock removed, '85, 1299.

1885-'86. 1,254 snags and 5,477 cubic yards rock removed, '86, 1163.

1886-'87. 3,232 trees, logs, and snags and 4,261 cubic yards of rock removed, '87, 1280.

Plans.

By Capt. Hoxie, 1887, for an extension of the improvement from Montezuma to Old Agency by the removal of obstructions. Estimated cost, \$25,000, '87, 1290, 1291.

FLINT RIVER, GA.—Continued.**Projects.**

By Capt. Damrell, in 1873, modified in 1880 after more detailed surveys, for low-water navigable channel 3 feet deep and 100 feet wide from mouth of river to Albany, Ga., a distance of 105 miles, and a navigable channel for light-draught steamers, at moderate stages of water, from Albany to Montezuma, a distance of 100 miles, to be secured by removal of snags, scouring bars by works of contraction, and cutting through rock reefs. Estimated cost, \$190,962, '73, 707, 721; '80, 1073; '86, 1162; '87, 1278.

Surveys.

Examination from Montezuma to Old Agency ordered by act of August 6, 1886. Made under direction of Capt. Hoxie, '87, 1290.

FLUSHING BAY, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 208.)

Appropriations.

1879.....	\$90,000
1880.....	15,000, '80, 509.
1881.....	10,000, '81, 633.
1882.....	5,000, '82, 659.
1884.....	10,000, '84, 723.
1886.....	10,000, '86, 662.

Total 70,000

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '87, 635.

Commerce.

Opposition of Newtown citizens to dike construction, '80, 508.

Contracts.

1879. H. Du Bois & Sons, pile-dike construction, '80, 509.

1880. W. Flannery, for dredging, at 17 cents per cubic yard, '81, 633.

1881. C. M. Pratt, for dredging, at 24 cents per cubic yard, '82, 659.

1882. H. N. & A. J. Beardsley, for dredging, at 19½ cents per cubic yard, '83, 560.

1884. H. Du Bois's Sons, for dredging, at 18 cents per cubic yard, '85, 667.

1886. P. S. Ross, for dredging, at 17½ cents per cubic yard, '87, 636.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 82; '81, 100; '82, 101; '83, 101; '84, 106; '85, 90; '86, 91; '87, 55.

ENGINEERS IN CHARGE.

Col. J. Newton, 1878-'83. Reports, '80, 508; '81, 631; '82, 657.

Lieut. Col. G. L. Gillespie, 1883-'85. Reports, '83, 559; '84, 724.

Lieut. Col. W. McFarland, 1885-'86. Report, '85, 666.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 661; '87, 634.

Operations.

1879-'80. 3,057 linear feet pile-dike built, '80, 508.

1880-'81. Channel 6,000 feet long and 65 feet wide dredged from 6-foot depth on East River side to corresponding depth at Flushing, '81, 632.

1881-'82. 36,000 cubic yards material dredged, '82, 657.

1882-'83. 31,959 cubic yards material dredged, '83, 560.

1883-'84. No operations, '84, 724.

1884-'85. 44,633 cubic yards material dredged, '85, 667.

1885-'86. No operations, '86, 662.

1886-'87. 26,630 cubic yards material dredged from channel leading up the bay and creek to Flushing; history of past operations, '87, 635.

Projects.

By Lieut. Col. Newton, 1879, for the formation of a tidal basin by dredging, and an inclosing pile-dike with an opening near the head of the bay, which, by filling and discharging through the main channel, would maintain a depth of 6 feet at mean low water. Estimated cost, \$173,500, '79, 62, 385, 387; '86, 661; '87, 634.

Surveys.**MAPS.**

'83, 660

FORESTVILLE HARBOR, LAKE HURON, MICH. — EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 294.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe, 1886. Report, '87, 2273.

Plans.

Lieut. Col. Poe, 1886, reported the harbor as unworthy of improvement in view of great probable cost of the same, '87, 2273.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Poe, '87, 2273.

FORKED DEER RIVER. (See DEER RIVER, SOUTH AND NORTH FORKS OF.)**FORT BROWN, TEX.—PROTECTION OF THE RIVER BANKS FROM THE EN-CROACHMENT OF THE RIO GRANDE.**

(Continued from Vol. I, p. 209.)

Appropriations.

1876-'79 \$17,000

1882 1,000, '82, 1491.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 149; '81, 203; '82, 201; '83, 205; '84, 220; '85, 230; '86, 227; '87, 192.

ENGINEERS IN CHARGE.

Capt. W. R. Livermore, 1880, '80, 149.

Maj. C. W. Howell, 1880, '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1273; '81, 1374; '82, 1491; '83, 1097; '84, 1320; '85, 1470; '86, 1336.

Maj. O. H. Ernst, 1886-'— Report, '87, 1434.

ASSISTANT.

H. C. Ripley. Report, '81, 1375.

Operations.

1879-'80. Completion of bank protection by use of brush mats, '80, 1724. No further work considered necessary, '80, 150.

1880-'81. Repairs to existing work, '81, 1374.

1881-'87. No operations from abandonment of project, '82, 1491; '86, 1336; '87, 1434.

Projects.

By means of a pile-jetty and shore protection it was proposed to arrest the encroachments of the river which threatened to destroy the military post and entirely change the channel of the river, '77, 475; '82, 201.

After an expenditure of \$16,769 it was decided in 1882 to abandon further efforts to control the action of the river, '82, 201; '86, 227; '87, 1434.

FORT COVINGTON, N. Y. (See SALMON RIVER.)**FORT LEAVENWORTH, KANS. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****FORT MADISON, IOWA. (See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)**

FORT MIFFLIN BAR. (See DELAWARE RIVER.)**FOUR CHANNELS, LAKE CHAMPLAIN.** (See LAKE CHAMPLAIN, N. Y. AND VT.)**FOURCHE LA FEVE RIVER, ARK.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 210.)

Appropriations.

1879.....	\$10,080
1880.....	4,000, '80, 1325.
1881.....	3,000, '81, 1514.
1882.....	4,000, '82, 1583.
1886.....	5,080, '87, 1532.

Total 26,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 155; '81, 218; '82, 215; '83, 223.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1879-'81. Reports, '80, 1323; '81, 1435.

Capt. T. A. Handbury, 1881-'83. Reports, '81, 1514; '82, 1583; '83, 1171.

Capt. H. S. Taber, 1886-'— Report, '87, 1531.

Operations.

1879-'80. Removal by hired labor of 7,557 trees and snags, and a number of rocks removed at shoals, '80, 1324.

1880-'81. 53 snags removed, rocks taken from shoals, and small dams built, '81, 1435, 1514.

1881-'82. 476 logs and snags removed, '82, 1583.

1882-'83. Removal of snags and trees, '83, 1172. Operations discontinued to 1886, '87, 1531.

1886-'87. Partial formation of channel through Rock Shoal, '87, 1531.

Projects.

By Maj. Benyaurd, 1879, for the removal of snags, bowlders, and leaning trees, at an estimated cost of \$23,034.50, '79, 972; '81, 1435.

FOURCHE RIVER, ARK. (See FOURCHE LA FEVE RIVER.)**FOX AND WISCONSIN RIVERS—IMPROVEMENT OF.**

(Continued from Vol. I, p. 211.)

Appropriations.

1839-'79	\$2,096,500
1880.....	125,000, '80, 1952.
1881.....	125,000, '81, 2135.
1882.....	200,000, '82, 2167.
1884.....	160,000, '84, 1874.
1886.....	56,250, '86, 1689.

Total 2,762,750

1888 (below Montello). 100,000, act of August 11, 1888.

Commerce.**TOLLS COLLECTED.**

1880.....	\$2,726.08, '80, 1952.
1881.....	2,336.99, '81, 2135.
1882.....	2,100.40, '82, 2167.
1883.....	625.00, '83, 1714.

Collection of tolls discontinued by act of 1882, '83, 1714.

FOX AND WISCONSIN RIVERS—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 209; '81, 223; '82, 278, 279, 2182, 2183, 2193; '83, 287, 1725, 1731, 1736, 1737; '84, 287, 1882, 1899; '85, 310, 2045; '86, 304; '87, 270-272.

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1871-'84. Reports, '80, 1947; '81, 2131; '82, 2165, 2183, 2190, 2194; '83, 1712, 1726, 1732, 1737; '84, 1872, 1887, 1925, 1939.

Capt. W. L. Marshall, 1884-'—. Reports, '84, 1872; '85, 2625; '86, 1686; '87, 2077, 2097.

ASSISTANTS.

Capt. F. A. Hiuman. Reports, '80, 1961, 1967; '81, 2135, 2140, 2141; '82, 2174, 2167; '83, 1714.

C. A. Fuller. Reports, '80, 1969; '81, 2144; '82, 2178; '83, 1721; '84, 1874; '85, 2033; '86, 1695; '87, 2081.

J. W. Allen. Reports, '83, 1719; '84, 1878, 1890; '85, 2038, 2040.

N. M. Edwards. Report, '83, 1735.

BOARD OF ENGINEERS.

Convened at New York, November 24, 1879, to report on plan for improvement of Wisconsin River. Report, '80, 1953. (Cols. Tower and Newton and Maj. Abbot and Houston.)

Convened at Milwaukee, September 1, 1882, by S. O. No. 81, to report upon plan for restoration to natural width and capacity of Lower Fox River channel; also, for maintenance of Lake Winnebago and Little Buttes des Morts, at their natural heights, by alterations in dams at Menasha and Appleton, '83, 1725, 1727, 1738. (Lieut. Col. Houston and Maj. Robert and Benyaurd.)

Convened at New York January 5, 1884, to report upon proviso in river and harbor bill of March 1, 1883. Report, '84, 1900, 1919. (Col. Newton and Lieut. Cols. Abbot and Comstock.)

Convened by S. O. No. 98, at Milwaukee, September 17, 1884, to report on construction of works, purchase of lands, and present depth of water required in Upper and Lower Fox, '85, 2041. (Lieut. Cols. Poe, Merrill, and Barlow, and Capt. Marshall.)

Convened at New York December, 1886, to determine the practicability of contracting the Wisconsin River sufficiently to obtain a low-water navigable depth of 4 or 5 feet by low brush dikes and wing-dams on the bed of the stream. Report, '87, 2094. (Cols. Casey and Abbot, Lieut. Cols. Comstock, Houston, and McFarland.)

Legislation.

Chief of Engineers recommends inquiry into damages caused by Fox and Wisconsin improvement, '81, 2149.

Wisconsin State law governing ascertainment and payment of damages caused by Government works, '81, 2148. Act of Wisconsin Territory, 1848, authorizing construction of Menasha Dam, '82, 2185; claims against United States in 1875 for damages caused by Menasha Dam, '82, 2187. Report on same by Maj. Houston, '82, 2190.

Awards for flowage claims previous to 1876, '82, 2190.

Necessity for ascertaining legal powers of United States in question, '82, 2196.

Proviso of 1882, '83, 1727.

Statement of leading points in suit of Syne *vs.* Fuller, '84, 1887; judgment for Syne delivered by Supreme Court, '84, 1896.

List of awards made in 1876 for flowage damages, '84, 1891.

Operations.**FOX RIVER.**

1879-'80. Lower Fox: Construction of new lock at Little Chute; construction of revetment wall of Appleton Canal, and waste-weir in third level of same; canal banks strengthened and break of Menasha repaired. Upper Fox: 460,931 cubic yards material dredged; repairs to Portage guard-lock and dams at Eureka, Berlin, White River, and Princeton; snags removed, '80, 1950.

1880-'81. Lower Fox: Completion of new lock at Little Chute; construction of masonry wall across head of old guard-lock; elevation of canal banks; completion of revetment wall of Appleton Canal; construction of waste-weir in Little Chute Dam; general repairs to locks and dams. Upper Fox: 519,473 cubic yards material dredged; construction of lock-tender's house at White River; minor repairs to dams, locks, and canal banks, '81, 2133.

1881-'82. Lower Fox: Construction of stone-masonry lock at Kaukauna. Upper Fox: 335,681 cubic yards material dredged; 800 linear feet of river bank protected from washing, by piles, brush, and stone, '82, 2165, 2166.

FOX AND WISCONSIN RIVERS—Continued.**Operations—Continued.****Fox River—Continued.**

1832-'83. Lower Fox: Construction of retaining-wall for canal bank above Kaukauna; construction of first new lock at Appleton, and alteration of dams at Menasha and Appleton commenced. Upper Fox: 124,206 cubic yards material dredged; repairs to locks, dams, and canal banks, '83, 1713.

1833-'84. Lower Fox: Appleton first lock completed; sluice-ways and gates built in Appleton Upper Dam; water on bars and in canals deepened by dredging; repairs to lock gates, canal embankments, and dams. Upper Fox: Repairs to lock gates at Fort Winnebago, Governor's Bend, Princeton, Berlin, and Eureka, '84, 1872.

1884-'85. Upper Fox: 74,371 cubic yards material dredged; boats and dredges repaired, '85, 2025. Lower Fox: Repairs to old lock at Menasha and to Appleton fourth and Little Chute first locks; new abutment built and apron begun at Little Kaukauna Dam; repairs to locks and dams and dredging in canals, '85, 2026.

1885-'86. Upper Fox: Old locks at Governor's Bend and Montello repaired; 97,506 cubic yards material dredged from bars in Upper Fox; repairs to Eureka Dam. Lower Fox: Right abutment and 178 linear feet of new dam at Menasha built; 1,506 cords stone blasted and removed from Menasha Channel; 20,449 cubic yards clay dredged from outlet of Lake Winnebago; apron completed and sluice built in Little Kaukauna Dam; repairs to locks and dams, '86, 1687.

1886-'87. Upper Fox: Repairs to locks and dams and maintenance of existing depth of navigation by dredging; levee built at White River Lock, '87, 2077, 2082, 2087. Lower Fox: New lock built at the Cedars; De Pere Lock renovated; Menasha Dam and sluice completed; Menasha Channel deepened by rock removal; De Pere Dam completed; new stone abutment built at Rapid Croche Dam, and the injury from high water of 1881 repaired, '87, 2078, 2082, 2084, 2087. History of operations, '87, 2094. Statement of total expenditures on Fox and Wisconsin rivers, '87, 2106.

WISCONSIN RIVER.

1879-'80. Repairs and extensions to dams between Portage City and Wild Cat Bluffs; five dams with a total length of 4,625 feet built above Prairie du Sac; 530 feet of dam extension on upper section; brush and stone collected, '80, 1951.

1880-'81. 41 wing-dams with a total length of 19,308 feet constructed between Portage and Rocky Run, '81, 2133.

1881-'82. 7,441 linear feet wing-dam constructed, '82, 2166.

1882-'83. 9,320 linear feet wing-dam constructed, '83, 1713.

1883-'84. No operation through lack of funds, '84, 1872.

1884-'85. Repairs to dams, '85, 2025; '86, 1646; '87, 2077.

1885-'86. Further efforts to improve river by wing-dams discontinued, '87, 2077, 2096.

Physical Characteristics.

Water-gauge record at Portage City, Fort Winnebago, and Governor's Bend locks, Wisconsin River, '80, 1966-1977.

Movement of bars in Wisconsin River, '80, 1969. Discharge of Wisconsin River, '84, 1904; '87, 2097.

Projects.

The permanent works for the improvement of the Fox and Wisconsin rivers were purchased by the United States in 1872 from the Green Bay and Mississippi Canal Company for \$325,000, '72, 35; '73, 219. The subsequent project proposed slack-water navigation of the Fox River by replacing the temporary structures with permanent works and the construction of 5 additional locks on the Upper Fox, the improvement of the Wisconsin River by wing-dams and dikes, so as to obtain throughout a depth of 6 feet for a width of 100 feet. Estimated cost, \$3,745,663, '75, 1, 218; '78, 1170; '80, 1952; '87, 370.

By Board of Engineers, 1884, for reconstruction of dam at Menasha, below site of present dam, across full width of Menasha Channel, and enlargement of Neenah Channel by dredging; also, for purchase of lands and structures, '85, 2044; '86, 1689.

The Board of Engineers of 1886 decided against further attempts to improve the low-water navigation of the Wisconsin River by wing-dams, '87, 2096.

Surveys.

Examination of Wisconsin River from Portage to Merrill. Made, 1882, under direction of Lieut. Col. Houston, '84, 1939.

FRANKFORD CREEK, PA.—IMPROVEMENT OF.**Appropriations.**

1882..... \$10,000, '83, 612.

Commerce.

Statement of manufacturing industries concerned.

Value and capacity of the Frankford Arsenal, '82, 836, 837.

Contracts.

1883. American-Dredging Company, for dredging, at 23 cents per cubic yard, '83, 612.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 197; '83, 117; '84, 137; '85, 119; '86, 116; '87, 78.

ENGINEERS IN CHARGE.

Capt. W. Ludlow, 1881-'83. Report, '82, 522.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 611.

Maj. W. H. Heuer, 1884-'85. Report, '84, 810.

Lieut. Col. H. M. Robert, 1885-'— . Reports, '85, 836; '86, 829; '87, 799.

ASSISTANTS.

E. A. Giesler. Report, '82, 824.

A. Stierle. Reports, '83, 612; '84, 811.

Operations.

1882-'83. 35,178 cubic yards material dredged from the channel, '83, 612.

1883-'87. No operations, '84, 811; '85, 836; '86, 829; '87, 799.

Physical Characteristics.

Description of creek and its obstructions, '82, 823.

Projects.

By Capt. W. Ludlow, 1882, for excavation of a channel from the mouth of the creek to Frankford Avenue Bridge, having a low-water depth of 7 feet at the mouth, decreasing to 3 feet at the bridge with a bottom width of 50 feet. Estimated cost, \$40,000, '82, 823.

No further operations recommended, '84, 811; '87, 799.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1883, under direction of Capt. W. Ludlow, '82, 823.

FRANKFORT (AUX BECS SCIENS) HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 218.)

Appropriations.

1886-'79	\$213,659.85
1880.....	5,000.00, '80, 2010.
1881.....	10,000.00, '81, 2201.
1882.....	15,000.00, '82, 2284.
1884.....	5,000.00, '84, 1974.
1886.....	7,000.00, '86, 1758.

Total..... 255,659.85

1888..... 8,000.00, act of August 11, 1888.

Contracts.

1879. H. S. Dale, for materials and labor, '80, 2010. Closed before completion, '80, 2009.

1880. N. G. Dodge, for dredging, at 15 cents per cubic yard, '81, 2201.

1882. Dewar & Wing, for pier construction, '83, 1808. Green Bay Dredge and Pile Driver Company, for dredging, at 24 cents per cubic yard, '83, 1809.

1886. D. Dake, for materials, '86, 1758.

1887. L. E. Allen, for repair and extension of pier, '87, 2179.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 214; '81, 230; '82, 235; '83, 292; '84, 294; '85, 315; '86, 310; '87, 278.

BOARD OF ENGINEERS.

Convened July 20, 1882, at Grand Rapids, Mich., by S. O. No. 65, C. of E., 1882, to report upon modification of crib superstructure as proposed by Maj. Heap. Report, '83, 1811.

(Majs. Houston, Smith, and Benyard.)

FRANKFORT (AUX BECS SCIÉS) HARBOR, MICH.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. F. Harwood, 1880-'82. Reports, '80, 2009; '81, 2200.

Maj. D. P. Heap, 1882-'83. Reports, '82, 2283; '83, 1810.

Capt. D. W. Lockwood, 1883— . Reports, '83, 1807; '84, 1973; '85, 2068; '86, 1757; '87, 2179.

Operations.

1879-'80. 13,350 cubic yards material dredged, '80, 2009.

1880-'81. 13,500 cubic yards material dredged, '81, 2200.

1881-'82. 100 linear feet crib-work sunk in extension of south pier; cribs at outer end of south pier leveled up and superstructure built; 77 cords of stone placed in superstructure, '82, 2283. Plan by Maj. Heap, 1883, for modified crib superstructure, '83, 1808, 1810, 1811.

1882-'83. Work on modified superstructure completed; 10,028 cubic yards material dredged; 50 linear feet of crib-work added to south pier, '83, 1808.

1883-'84. Modified superstructure placed on end of south pier, '84, 1973.

1884-'85. 337 linear feet revetment on north side of channel and 187 linear feet on south side rebuilt, '85, 2068.

1885-'86. No operations for lack of funds, '86, 1757.

1886-'87. 396 linear feet north revetment completed; 230 feet south revetment repaired; south pier extended 50 feet, '87, 2179.

Projects.

By Col. Cram, 1866, for dredging new outlet through strip of land separating Lake Aux Becs Sciés from Lake Michigan, and building two parallel piers 200 feet apart, extending from 12-foot soundings in the inner lake to same depth in Lake Michigan. Estimated cost, \$88,541, '66, i, 34, 36. Amended in 1875 and in 1879 to \$254,196, '81, 2201; '87, 2179.

By Maj. Harwood, 1881, for completion of improvement by dredging, and 550 linear feet of pier extension. Estimated cost, \$100,000, '81, 2201.

Surveys.**MAPS.**

'82, 2284; '83, 1808; '84, 1973.

FREEDOM AND ROCHESTER, PA.—ICE-HARBOR AT.

(See OHIO RIVER AT ROCHESTER AND FREEDOM, PA.)

FRENCH BROAD RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 220.)

Appropriations.

1876-'79	\$30,000
1880.....	3,000, '80, 793.
1881.....	5,000, '81, 980.
1882.....	5,000, '82, 1059.

Total..... 43,000

List of appropriations previous to 1880, '80, 793.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 117; '81, 157; '82, 153; '83, 160; '84, 162; '85, 152; '86, 147; '87, 113.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1878— . Reports, '80, 791; '81, 978; '82, 1057; '83, 832; '84, 1002; '85, 997; '86, 929; '87, 958.

Operations.

History of operations, '80, 791.

1879-'80. Reef at Little Buck Shoals removed by blasting and dredging; 14 crib-work wing-dams completed; banks protected by brush and stone; two scows built, '80, 792.

FRENCH BROAD RIVER, N. C.—Continued.**Operations—Continued.**

1880-'81. 575 cubic yards rock blasted; 657 cubic yards rock removed; 2,215 cubic yards sand and gravel dredged; 170 logs, snags, and trees removed, '81, 980.
 1881-'82. Dredging and removal of obstructions continued; wing-dams built and repaired, '82, 1058.

1882-'87. No operations, '83, 832, 835; '84, 1003; '85, 998; '86, 929; '87, 959.

Projects.

By S. T. Abert, 1873, for a channel 35 feet wide and 2½ feet deep from Brevard to Big Buck Shoals, by construction of wing-dams, dredging, and rock removal. Estimated cost, \$45,500, '78, 74, 537, 538; '79, 648; '80, 791; '87, 958.

By S. T. Abert, 1883, for continuing the improvement from Smith's Bridge to foot of Long Shoal by rock removal and dredging. Estimated cost, \$76,000, '83, 836; '85, 998; '87, 958.

Surveys.

Examination of river, 1882, '82, 1058. Survey from Smith's Bridge to foot of Long Shoal, 1883, '83, 832.

FRENCH BROAD RIVER, TENN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 220.)

Appropriations.

1880.....	\$10,000, '80, 1680.
1881.....	3,500, '81, 1862.
1882.....	5,000, '82, 1860.
1884.....	3,500, '84, 1650.
1886.....	6,000, '86, 1521.

Total..... 28,000

1888..... 10,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 187; '81, 259; '82, 246; '83, 254; '84, 254; '85, 276; '86, 268; '87, 231.

ENGINEERS IN CHARGE.

Maj. W. E. King, 1880-'86. Reports, '80, 1679; '81, 1861; '82, 1848; '83, 1862; '84, 1650; '85, 1765.

Lieut. Col. J. W. Barlow, 1886-'— . Reports, '86, 1520; '87, 1751.

Operations.

1879-'80. No operations, '80, 1680.

1880-'81. 520 cubic yards gravel dredged, 967 cubic yards rock quarried, 300 cubic yards earth embankment and 575 linear feet crib-dams built, and 1,250 linear feet old (State) dams repaired, '81, 1861.

1881-'82. 5,282 cubic yards rock put into 25 dams; boulders and gravel removed from the channel, '82, 1849.

1882-'83. 1,386 cubic yards stone quarried; 3,871 cubic yards riprap dams built; boulders, snags, and trees removed from channel, '83, 1494.

1883-'84. No operations for lack of funds, '84, 1650.

1884-'85. 164 cubic yards rock blasted; 569 cubic yards gravel and 374 boulders excavated; 796 cubic yards rock quarried and 468 cubic yards rock placed in dams, '85, 1765.

1885-'86. Riprap dam at Sewee Shoals completed, '86, 1521.

1886-'87. Repair to dams at Fains Island, '87, 1751.

Projects.

By Lieut. Adams, 1870, for securing a channel 2½ feet deep from Leadvale to mouth, a distance of 90 miles, by construction of wing dams and removal of snags and obstructions. Estimated cost, \$150,000, '71, 493, 494; '80, 187, 1680; '86, 1520.

GALENA RIVER AND HARBOR, ILL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 220.)

Appropriations.

1878-'79.....	\$42,000
1880.....	12,000, '80, 1549.
1881.....	12,000, '81, 1723.

GALENA RIVER AND HARBOR, ILL.—Continued.**Contracts.**

1879. H. S. Brown, for dredging, '80, 1549. Whitney & Son, for dredging, '80, 1549.

1881. Whitney & Son, for dredging, '81, 1798. Informal agreement with Whitney & Son and H. S. Brown, for dredging, '81, 1727.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 176; '81, 237; '82, 235.

ENGINEER IN CHARGE.

Capt. A. Mackenzie, 18-0-'82. Reports, '80, 1548; '81, 1727; '82, 1791.

ASSISTANT.

M. Meigs. Report, '82, 1792.

Operations.

1879-'80. 72,902 cubic yards material dredged, '80, 1548.

1880-'81. Harbor dredged to low-water grade and cut made from above cut-off to woolen mill, '81, 1727.

1881-'82. 51,358 cubic yards material dredged, '82, 1793.

Projects.

By Maj. Farquhar, 1873, for dredging the cut-off to a depth of 6 feet above and 4 feet below; closing of Harris Slough; also the construction of dams of dry masonry backed by earth across the three principal ravines, so as to intercept sediment from inflowing streams. Estimated cost, \$400,000, '74, i, 290, 291, 292; '78, 98; '80, 1548.

Surveys.

Of river from Galena to junction with Mississippi River, 1879, '80, 1548.

GALLOP'S RAPIDS, St. Lawrence River. (See ST. LAWRENCE RIVER.)**GALVESTON BAY SHIP-CHANNEL, TEX.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 221.)

Appropriations.

1872-'79	\$292,000
1880	50,000, '80, 1238.
1881	50,000, '81, 1334.
1882	94,500, '82, 1457.

Total 486,500

1888..... 100,000, act of August 11, 1888.

Commerce.

The necessity of channel less than formerly and not called for by interests of commerce, '83, 202, 1082.

Contracts.

1881. J. E. Slaughter, for dredging, at 13 $\frac{1}{2}$ cents per cubic yard, '81, 1333.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 147; '81, 200, 1334; '82, 196; '83, 202, 1080; '84, 217; '85, 226; '86, 224; '87, 189.

BOARD OF ENGINEERS.

Convened by S. O. No. 9, C. of E., 1883. Report, '83, 1078. The Board did not consider it probable that a channel of the proposed depth would be permanent through the Morgan Cut, '83, 1081, 1082. (Maj. Mansfield; Capts. Lamrell and Heuer.)

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1871-'80. Report, '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1236; '81, 1332; '82, 1456; '83, 1075; '84, 1303; '85, 1454; '86, 1322.

Maj. O. H. Ernst, 1886-'— . Report, '87, 1417.

ASSISTANT.

Capt. C. E. L. B. Davis. Report, '80, 1236.

GALVESTON BAY SHIP-CHANNEL, TEX.—Continued.**Legislation.**

Proviso attached to act of March 3, 1879, relating to Bayou Ship-Channel Company, '79, 214.

Subsequent action relating thereto, '81, 1334; '82, 1457; '84, 394.

Operations.

History of operations from 1872-'82, '83, 1076, 1079, 1879, 1880. 510,379 cubic yards dredged from channel in Lower Galveston Bay, '80, 1236.

1880-'81. No operations, '81, 200.

1881-'82. 160,440 cubic yards dredged from channel, '82, 1456.

1882-'83. 801,789 cubic yards dredged from channel, '83, 202, 1075. Work done not permanent, '83, 1078, 1080.

1883-'86. No operations pending further action of Congress, '84, 217; '85, 227; '86, 224, 1322.

1886-'87. Survey of channel; preparations for resumption of dredging, '87, 1419, 1421.

Private and Corporate Work.

Proviso attached to act of March 3, 1879, requiring the Bayou Ship-Channel Company to surrender their rights before application of appropriation of 1880, '79, 214. Action relating thereto and subsequent compliance of the company, '81, 1334, 1338; '82, 1457.

Projects.

The project of 1871-'77 proposed the formation of a dredged channel 100 feet wide at bottom and 12 feet deep at mean low water from the head of Bolivar to the U. S. Cut through Red Fish Bar, thence to the cut through Morgan's Point. Estimated cost, \$446,326.42, '78, 608; '79, 918; '80, 1237; '87, 1418. Improvement not considered permanent, '79, 918; '83, 1078.

In 1883 the Board of Engineers considered that the channel could not be made permanent at any reasonable cost, '83, 1081. Recommended by Chief of Engineers that available funds be reserved pending the action of Congress, '83, 1082; '84, 217.

**GALVESTON AND BRAZOS RIVER, TEX., Canal to connect—
EXAMINATION FOR.****Engineers.**

CHIEF OF ENGINEERS.

Report, '81, 204.

ENGINEER IN CHARGE.

Maj. S. M. Mansfield. Report, '81, 1376.

ASSISTANT.

W. L. Webb. Report, '81, 1376.

Physical Characteristics.

General description of route, '81, 1377.

Plans.

By Maj. Mansfield, 1880, for the construction of a canal about 38 miles long, 80 feet wide, and 4 feet deep. Estimated cost, \$70,353, '81, 1376, 1379.

Surveys.

Ordered by act of March 3, 1879, '81, 204.

GALVESTON HARBOR, TEX.—IMPROVEMENT OF ENTRANCE TO.

(Continued from Vol. I, p. 224.)

Appropriations.

1870-'79	\$653,000
1880	175,000, '80, 1207.
1881	250,000, '81, 1328.
1882	400,000, '82, 1446.
1886	300,000, '86, 1293.

Total	1,778,000
1888	500,000, act of August 11, 1888.

GALVESTON HARBOR, TEX.--Continued.**Commerce.**

Value of improvement as obtained in 1885, '85, 1451.

Draught of vessels passing outer bar, '85, 1451.

Contracts.

1881. T. K. Thompson, for cordage; Shannon & Hyatt, for brush; Gulf, Colorado and Santa Fé Railroad, for stone, '81, 1327.

1883. Hitchcock & Byrnes, for stone; A. M. Shannon, for brush; H. Marwitz & Co. and A. Flake & Co., for cordage; Burnett & Ross, for cane; I. Heffron, for handling stone, '82, 1442, 1443; '83, 1060, 1061, 1070.

1887. A. M. Shannon & Co., for raising height of old south jetty, '87, 1416.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 147; '81, 199; '82, 196; '83, 201; '84, 216; '85, 226; '86, 223, 1294; '87, 189.

BOARD OF ENGINEERS.

Convened August 9, 1879, to consider the improvement of the entrance to Galveston Harbor. Report, '80, 1266. Board recommend that no more gabions be made, but that the 600 on hand be strengthened and used as a further trial of their value. They also suggested a trial of the Dutch system of jetty construction by use of alternate layers of mattress and stone, '80, 1270, 1271.

Reconvened June, 1880. Report, '80, 1221. The Board recommend the use of broad foundation mattress covered with brush and stone or concrete blocks, '80, 1227, 1230. Observations by Board on mattress construction, '82, 1452.

(Cola Tower and Newton and Lient. Col. Gilmore.)

Convened January, 1886. Report, '86, 1297. The Board recommend to build up and complete the present south jetty to crest of outer bar; to build a north jetty to crest of outer bar; to extend both jetties to the 30-foot curve in the Gulf; to do such dredging from time to time, in aid of tidal scour, as the rate of appropriation given may afford, '86, 1292.

(Col. Duane and Lient. Cola. Abbot and Comstock.)

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1871-'80. Report, '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1204, 1231; '81, 1326; '82, 1441; '83, 1059; '84, 1295; '85, 1449; '86, 1291, 1311, 1315.

Maj. O. H. Ernst, 1886-'91. Report, '87, 1415.

ASSISTANTS.

Capt. C. E. L. B. Davis. Report, '80, 1208, 1232.

H. C. Ripley. Reports, '80, 1210, 1219, 1231; '82, 1447; '83, 1073; '84, 1300.

W. H. Burke. Report, '81, 1328.

W. A. Hinkle. Reports, '82, 1450; '83, 1071; '84, 1299.

Operations.

1879-'80. 2,278 linear feet added to Bolivar Gabionade, '80, 1208. Placing of gabions discontinued and mats loaded with concrete blocks substituted, '80, 1209, 1227. Description of gabion construction, '80, 1232.

1880-'81. Extension of south jetty with brush and cane mattress ballasted with concrete and stone, '81, 1326, 1328, 1329; '82, 1441.

1881-'82. 111,393 cubic yards of brush mattress and stone ballast placed in south jetty, '82, 1442, 1445. Cost of jetty per cubic yard, \$2.88, '83, 1066.

1882-'83. 107,555 cubic yards of brush mattress and stone ballast placed in south jetty, '83, 1060, 1066, 1071. Cost of jetty per cubic yard, \$2.83, '83, 1066.

1883-'84. 38,204 cubic yards of brush mattress and stone ballast placed in south jetty, '84, 1296, 1299. Cost per cubic yard, \$3.17, '84, 1296; '85, 1450; '86, 1305.

1884-'86. No operations from lack of funds, '85, 1450; '86, 1293.

History of operations from 1880 to 1885, '86, 1292.

1886-'87. Preparations for resumption of work on south jetty, '87, 1416.

Physical Characteristics.

Description of Galveston Bay, '86, 1297.

Description of Galveston Bar, '86, 1298.

Area of cross-sections at Bolivar Bar, '80, 1213.

Wind diagrams and observations, '80, 1220; '86, 1299.

Tides, '86, 1300. Physical changes, '86, 1303.

Action of Terebo, '86, 1312, 1314, 1316.

Private and Corporate Work.

\$100,000 appropriated in 1883 by city of Galveston to continue work, '83, 1063, 1068; '84, 1296.

Projects.

From 1870 to 1872, inclusive, \$76,000 was appropriated, which was expended in building and operating a dredge on the inner bar and in strengthening the Fort Point Jetty, '71, 517; '72, 554; '74, i, 724.

GALVESTON HARBOR, TEX.—Continued.**Projects—Continued.**

The project of 1874 by Capt. Howell proposed the removal of the inner bar between Fort Point and Pelican Spit, and deepening the channel over the outer bar to 18 feet; it was proposed to effect the first by continuing the city dike to the edge of Bolivar Channel and thereby secure sufficient contraction to scour the desired channel. The second was to be accomplished by prolonging the first dike seaward and by the construction of a parallel dike from Bolivar Point. In place of stone it was proposed to use gabions covered with hydraulic cement and filled with sand, '74, i, 782, 736; '80, 1221.

From 1874 to 1879, inclusive, \$577,000 was appropriated under this project, resulting in a 20-foot channel over the inner bar, '80, 147.

In 1879 a Board of Engineers recommended that no more gabions be made, and that those on hand be strengthened and used for further experiment; also that trial be made of the Dutch system of jetties composed of alternate layers of mattress and stone, '80, 1270.

In 1880 the Board of Engineers further recommended the use of broad foundation mattress covered with brush and stone or concrete blocks, '80, 1227, 1230. Sketches of jetties as proposed, '80, 1228. Estimated cost, including appropriation of 1880, \$1,825,813, '81, 1328. Least depth proposed over outer bar, '84, 217; '85, 1450; '86, 1297.

The Board of 1886 recommended to build up and complete the present south jetty to the crest of the outer bar; to build a north jetty to crest of bar; to extend both jetties to the 30-foot curve in the Gulf; to do such dredging from time to time, in aid of tidal scour, as the rate of appropriation given may afford, '86, 1292.

Interval between outer ends of jetties to be 7,000 feet, '86, 1308. Depth to be obtained, '86, 223, 1309, 1311. General plan of construction, '86, 1310. Estimated cost, \$7,000,000, in addition to \$1,478,000 appropriated previous to 1886, or an aggregate of \$8,478,000, '86, 1311; '87, 1416.

Surveys.

Previous to 1880, '80, 1266.

MAPS.

Of harbor, '80, 1206; '82, 1444; '83, 1074; '84, 1300.

Entrance, '87, 1416.

GASCONADE RIVER, MO.—IMPROVEMENT OF.

(Continued from Vol. I, p. 226.)

Appropriations.

1880.....	\$5,000, '80, 1461.
1881.....	10,000, '81, 1660.
1882.....	10,000, '82, 1731.
1884.....	5,000, '84, 1540.
1886.....	7,500, '86, 1397.

Total 37,500

1888..... 5,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 168, 169; '81, 229; '82, 226; '83, 233; '84, 237; '85, 254; '86, 247; '87, 214.

ENGINEERS IN CHARGE.

Maj. C. H. Suter, 1879-'85. Reports, '80, 1461; '81, 1660; '82, 1731; '83, 1337; '84, 1540.

Maj. A. M. Miller, 1885-'—. Reports, '85, 1637, 1654; '86, 1396; '87, 1590.

ASSISTANT.

T. T. Johnston. Reports, '80, 1462; '83, 1338.

Operations.

1880-'81. Removal of snags and similar obstructions commenced, '81, 1660.

1881-'82. Removal of snags continued, '82, 1731.

1882-'83. Removal of snags completed throughout 78 miles of river, '83, 1337.

1883-'84. No operations, '84, 1540.

1884-'85. 194 snags removed; banks cleared; repairs to wing-dam, '85, 1637.

1885-'86. No operations, '86, 1396.

1886-'87. 1,888 trees and snags removed, '87, 1590.

GASCONADE RIVER, MO.—Continued.**Physical Characteristics.**

Description of river, '80, 1462.

Projects.

By Maj. Suter, 1880, for improvement of river from its mouth to Vienna, a distance of 78 miles, by removal of snags and similar obstructions. Estimated cost, \$50,000, '80, 1466.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Suter, '80, 1461.

GAULEY RIVER, W. VA.

Examination ordered by act of August 5, 1886, '87, 253.

[\$3,000 appropriated by act of August 11, 1888.]

GEDNEY'S CHANNEL, New York Harbor. (See NEW YORK HARBOR.)**GEORGETOWN HARBOR, D. C. (See POTOMAC RIVER IN VICINITY OF WASHINGTON.)****GEORGETOWN HARBOR, S. C.—IMPROVEMENT OF.****Appropriations.**

1882..... \$7,000, '83, 872.
 1884..... 5,000, '84, 1052.
 1886..... 5,000, '86, 1082.
 1888..... 7,500, act of August 11, 1888.

Contracts.

1884. C. Gilbert, for dredging, at 12½ cents per cubic yard, '85, 1115.
 1887. C. Gilbert, for dredging, at 30 cents per cubic yard, '87, 1076.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 168; '83, 171; '84, 177; '85, 174; '86, 172; '87, 135.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'83. Report, '81, 1036.
 Capt. J. Mercur, 1883-'84. Report, '83, 872.
 Capt. F. A. Hinman, 1884-'85. Report, '84, 1052.
 Capt. W. H. Bixby, 1885-'—. Reports, '85, 1114; '86, 1027; '87, 1074.

ASSISTANTS.

C. W. Forster. Report, '81, 1037.
 R. Whitford. Reports, '85, 1116; '86, 1028; '87, 1076.

Operations.

1884-'85. 20,924 cubic yards material dredged from channel; snags and stumps removed, '80, 1115.
 1885-'86. 2,684 cubic yards sand dredged from channel; logs and stumps removed, '86, 1027. History of work, '86, 1029.
 1886-'87. 7,614 cubic yards dredged from bar at mouth of Sampit River, '87, 1075, 1076.

Physical Characteristics.

Description of, '81, 1037.

Projects.

By Capt. Phillips, 1881, for dredging channel 200 feet wide, with a depth of 12 feet through shoal across the mouth of Sampit River one-half mile from Georgetown. Estimated cost, \$14,151.50, '81, 1033; '86, 1029; '87, 1074.
 In 1885 \$12,000 had been appropriated and Capt. Bixby proposed the modification of the project so as to cover the removal of stumps not provided for in original project. Estimated cost, \$30,000, '85, 1117; '86, 1030. Increased in 1887 to \$42,000, '87, 1074.

GEORGETOWN HARBOR, S. C.—Continued.**Surveys.**

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Phillips, '81, 1036.

MAPS.

'85, 1114; '86, 1028.

Of Winyah Bay, '87, 1076.

GEORGETOWN AND WASHINGTON HARBORS, D. C. (See POTOMAC RIVER IN VICINITY OF WASHINGTON, D. C.)**GLASGOW, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****GLEN COVE HARBOR, N. Y.—EXAMINATION OF.**

[§20,000 appropriated by act of August 11, 1888.]

Commerce.

Present and prospective, '87, 646.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 56.

ENGINEER IN CHARGE.

Lieut. Col. D. C. Houston, 1886. Report, '87, 645.

ASSISTANT.

J. C. Sanford. Report, '87, 645.

Physical Characteristics.

Description of harbor, '87, 645.

Plans.

By Lieut. Col. Houston, 1886, for construction of 2,500 linear feet of riprap break-water, extending from Mosquito Point in a westerly direction. Estimated cost, \$201,960, '87, 646.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Houston, '87, 645.

GLOUCESTER HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 227.)

Appropriations.

1872.....	\$10,000
1886.....	5,000, '87, 504.
1888.....	10,000, act of August 11, 1888.

Commerce.

Justification of improvement, '85, 541; '87, 503.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 67.

ENGINEERS IN CHARGE.

Maj. C. Raymond. Report, '85, 534, 540, 541.

Lieut. Col. G. L. Gillespie, 1896.—. Report, '87, 500, 505.

ASSISTANT.

H. F. Bothfield. Reports, '85, 542; '87, 503.

Operations.

History of past operations, '87, 501.

Physical Characteristics.

Locality described, '85, 534, 542.

GLOUCESTER HARBOR, MASS.—Continued.**Plans.**

By Maj. Raymond, 1885, for the removal of a part of Babson's Ledge in completion of the original project, at an estimated cost of \$4,800, '85, 541, 543.

By Maj. Raymond, 1885, for the formation of a harbor of refuge by the construction of two breakwaters with an aggregate length of 7,250 feet, and at an estimated cost of \$1,359,000, '85, 535; '87, 501, 502.

By Lieut. Col. Gillespie, for the removal of Babson's Ledge, based upon late surveys, and the formation of a dredged channel 15 feet deep at low water, from Harbor Cove to Pew's Wharf, also the deepening of Harbor Cove to 10 feet. Estimated cost, \$65,000, '87, 503.

Projects.

The project of 1871 proposed to clear the harbor of sunken rocks and to build a stone breakwater from Eastern Point to Round Rock Shoal, '70, 870-875; '71, 873; '87, 500.

The appropriation of \$10,000 of 1872 was expended upon the removal of rock, '73, 1083; '87, 501.

See also PLANS.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Maj. Raymond, '85, 540; '87, 502, 505.

MAPS.

'87, 504.

Of inner harbor, '87, 506.

GOOSE RAPIDS ON RED RIVER OF THE NORTH—CONSTRUCTION OF LOCK AND DAM AT.

(See RED RIVER OF THE NORTH, MINN. AND DAK.)

GORDON'S LANDING, LAKE CHAMPLAIN, VT. — CONSTRUCTION OF BREAKWATER AT.**Appropriations.**

1886..... \$18,750, '87, 314.

1888..... 10,000, act of August 11, 1888.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 314.

ENGINEER IN CHARGE.

Maj. M. B. Adama, 1886— Report, '87, 2400.

Projects.

By Maj. Adama, 1887, for construction of a rubble-stone breakwater extending from a point 250 feet south of landing to a point on the 18-foot curve 100 feet north of line drawn from the dock to Cumberland Head. Estimated cost, \$38,158, '87, 2400.

Surveys.

MAPS.

'87, 2400.

GOWANUS BAY, N. Y.—IMPROVEMENT OF.**Appropriations.**

1881..... \$40,000, '81, 635.

1882..... 20,000, '82, 661.

1883..... 5,000, '84, 708.

1886..... 7,500, '86, 725.

Total 72,500

1888..... 60,000, act of August 11, 1888.

Statement of appropriations, '87, 713.

GOWANUS BAY, N. Y.—Continued.**Commerce.**

Commercial statement from 1880 to 1884, '84, 707.

Necessity for enlarged channels, '87, 712, 714.

Contracts.

1881. J. W. Ambrose, for dredging, at 17 cents per cubic yard, '82, 661.

1883. E. Brainard, for dredging, at 18 cents per cubic yard, '84, 708.

1884. H. Du Bois's Sons, for dredging, at 19 $\frac{1}{2}$ cents per cubic yard, '85, 673.

1886. E. Brainard, for dredging, at 32 cents per cubic yard, '87, 711.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 101; '82, 102; '83, 97; '84, 103; '85, 93; '86, 98; '87, 61.

ENGINEERS IN CHARGE.

Col. J. Newton, 1880-'84. Reports, '81, 634, 635; '82, 659; '83, 544.

Capt. J. Mercur, 1884-'86. Reports, '84, 706; '85, 672.

Lieut. Col. W. McFarland, 1886-'—. Reports, '86, 722; '87, 709.

ASSISTANT.

R. H. Talcott. Report, '81, 636.

Legislation.

Operations under appropriations of 1882 prevented by legal formalities for securing right of way, '83, 544; '87, 710.

Operations.

1881-'82. 153,458 cubic yards material dredged, '82, 659.

1882-'83. 60,708 cubic yards material dredged, '83, 544.

1883-'84. 91,609 cubic yards material dredged, '84, 706.

1884-'85. 22,996 cubic yards material dredged, '85, 673.

1885-'86. No operations, '86, 723.

1886-'87. 21,497 cubic yards dredged from channel below Hamilton Street Bridge, '87, 711.

Projects.

By Col. Newton, 1881, for dredging channel 200 feet wide and 18 feet deep at mean low water from the 18-foot contour outside the bay to Hamilton Avenue Draw-bridge, the last few hundred feet narrowing down to a width of 100 feet. Estimated cost, \$182,850, '81, 636.

Revised project for dredging the natural channel from Hamilton Avenue Draw-bridge to southwest corner of Erie Basin, and thence two channels, one running northerly along the west side of Erie Basin to deep water near Red Hook, the other running southerly along the wharves on the south side of the bay. Estimated cost, \$192,564.90, '81, 672, 673; '87, 710.

In 1887 Lieut. Col. McFarland considered that the Red Hood, Bay Ridge, and Gowanus Creek channels should be widened to 400 feet with a low-water depth of 21 feet. Estimated cost, \$403,500, '87, 712.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Col. Newton, '81, 635.

MAPS.

'81, 636; '85, 672.

GOWANUS CREEK, N. Y.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 105.

ENGINEER IN CHARGE.

Col. J. Newton. Report, '84, 713.

Plans.

In 1882 a line of canal having taken the place of the creek, Col. Newton did not consider the creek worthy of improvement, '84, 714.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Col. Newton, '84, 713.

GRAND GULF, MISS.—HARBOR AT, SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaurd. Report, '81, 1470.

ASSISTANT.

H. St. L. Coppée. Report, '81, 1472.

Plans.

By Maj. Benyaurd, 1880, for dredging from Station O to Ferry at Big Black River, and thence to near Gauge No. 3. Estimated cost, \$1,054,780. Improvement not recommended, '81, 1476, 1477.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Benyaurd, '81, 1470.

GRAND HAVEN HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 224.)

Appropriations.

1852-79	\$303,866.15
1880	50,000.00, '80, 2023.
1881	50,000.00, '81, 2222.
1882	40,000.00, '82, 2369.
1884	50,000.00, '84, 1986.
1886	30,000.00, '86, 1766.

Total	523,866.15
-------------	------------

1888	25,000.00, act of August 11, 1888.
------------	------------------------------------

Commerce.

Losses to shipping occasioned by formation of bar across harbor mouth, '80, 2019, 2020.

Commercial importance, '80, 2021.

Contracts.

1880. H. S. Dale, for pier extension, canceled, '80, 2019. Squire & White, for re-
vetment construction, '81, 2222.

1881. J. W. Dennis, for pile foundation, '81, 2222.

1882. Gillen & Kirby, for pier construction and dredging, the latter at 40 cents per
cubic yard, '83, 1825.

1884. H. B. Herr, for pier construction, '85, 2080.

1886. T. W. Kirby, for stone and edgings, '86, 1767. Kelly, Maus & Co., for iron, at
2½ cents per pound, '86, 1767. Cutler & Savidge Lumber Company, for timber,
'86, 1767.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 217, 2023; '81, 204; '82, 288; '83, 296; '84, 297; '85, 319; '86, 314;
'87, 281.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80. '80, 2019.

Maj. F. Harwood, 1880-'82. Reports, '80, 2019, 2024; '81, 2219.

Maj. D. P. Heap, 1882-'83. Report, '82, 2307.

Capt. D. W. Lockwood, 1883-'— . Reports, '83, 1822; '84, 1984; '85, 2079; '86,
1766; '87, 2191.

Operations.

1879-'80. Channel through bar at harbor mouth redredged; superstructure on north
pier extension completed, '80, 2019.

1880-'81. Work commenced upon pile and slab revetment and south pier exten-
sion; extensive repairs to piers and revetments by day labor; wreck of schooner
Catchpole removed; 5,910 linear feet catch-sand fence built, '81, 2220, 2221.

1881-'82. 1,633 linear feet pile revetment completed and reinforced by anchor piers;
pile foundation for three cribs driven and cribs placed; 6,470 linear feet catch-
sand fence built; portions of north and south revetments refilled by hired labor,
'82, 2307, 2308.

GRAND HAVEN HARBOR, MICH.—Continued.**Operations—Continued.**

1882-'83. Three cribs placed in extension of south pier, riprap placed along channel face, and sheet piling along south face of same; 100 linear feet of crib work, with superstructure placed in extension of south pier; repairs, by day labor, to pile-pier and north and south revetment; 16 oak-timber aprons placed between piles and cuts; 1,960 linear feet catch-sand fence built, '83, 1822, 1823, 1824.

1883-'84. 700 linear feet superstructure on south pier rebuilt, '84, 1985.

1884-'85. 710 linear feet south pier and two outer cribs refilled and redecked; also 802 linear feet revetment repaired, by hired labor, '85, 2079.

1885-'86. South pier extended by 200 linear feet crib-work; breaches in pier-head and revetment repaired, '86, 1766.

1886-'87. Completion of new superstructure to north pier; repairs to piers; progress on cribs for south pier extension, '87, 2191.

Projects.

By Maj. Wheeler, 1866, revised in 1867, for construction of two parallel crib-work piers, 2,208 and 608 feet long, respectively, to afford a channel of entrance of navigable width and not less than 18-foot depth. Estimated cost, \$352,770.47, '76, 11, 494; '80, 217, 2033.

After an aggregate appropriation since 1866 of \$301,866.15, Maj. Harwood proposed, in 1880, the extension of piers to 18-foot water, beach protection, and repairs to existing works. Estimated cost, \$365,600, '80, 2024.

Surveys.

Resurvey made in 1882, '82, 2308. Survey of bar at head of piers, 1884, '84, 1984.

MAPS.

'82, 2310; '84, 1984.

GRAND LAKE, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '83, 212.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '83, 1131.

ASSISTANT.

H. C. Collins. Report, '83, 1131.

Physical Characteristics.

Grand Lake Bayou described, '83, 1132.

Plans.

Maj. Stickney considered that no improvement should be attempted until the route for entering the upper end of the lake is decided upon, '83, 1131.

Surveys.

Ordered by act of June 14, 1880, '80, 146.

Made under direction of Maj. Stickney, 1883, '83, 1131.

GRAND MARAIS HARBOR, MINN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 231.)

Appropriations.

1879.....	\$10,000, '79, 150.
1880.....	10,000, '80, 1883.
1881.....	20,000, '81, 2031.
1882.....	20,000, '82, 2107.
1884.....	10,000, '83, 1825.
1886.....	10,000, '86, 1638.

Total 80,000

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '87, 1955.

Contracts.

1879. Williams & Upham, for dredging, at 28 cents per cubic yard, '80, 1663.

1881. C. M. Wilson, for breakwater construction, '80, 2032.

GRAND MARAIS HARBOR, MINN.—Continued.**Contracts—Continued.**

1882. Williams & Upham, for dredging, at 30 cents per cubic yard, '83, 1625.
 C. P. Macdougall, for breakwater construction, '83, 1626.
 1884. Williams & Upham, for dredging, at 25 cents per cubic yard, '85, 1950.
 1886. Williams & Upham, for dredging, at 24½ cents per cubic yard, '87, 1956.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 201; '81, 270; '82, 265; '83, 274; '84, 273; '85, 295; '86, 289; '87, 255.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1879-'86. Reports, '80, 1882; '81, 2029; '82, 2106; '83, 1624; '84, 1822; '85, 1949; '86, 1637.

Capt. J. B. Quinn, 1886-'—. Report, '87, 1954.

Operations.

1879-'80. 19,199 cubic yards material dredged, '80, 1883.

1880-'81. 16,666 cubic yards material dredged, '81, 2030.

1881-'82. Mayhew Point breakwater built, '82, 2107.

1882-'83. Shore connection and bulkhead crib nearly finished, '83, 1624.

1883-'84. Work on breakwater continued; 16,667 cubic yards material dredged, '84, 1822.

1884-'85. 31,625 cubic yards material dredged; repairs and filling to breakwater, '85, 1949.

1885-'86. No operations, '86, 1638.

1886-'87. Dredging resumed, '87, 1956.

Physical Characteristics.

Situation and surroundings of harbor, '86, 1637.

Plans.

By Capt. Quinn, 1887, for an extension of the dredged area and the breakwater at an increase over the previously estimated cost of \$114,775, '87, 1954.

Projects.

By Maj. Farquhar, 1875, for dredging, within and bounded by Mayhew's Point and the inner shore-line, and construction of timber and stone breakwater to narrow the entrance and afford shelter for vessels. Estimated cost, \$139,669.40, '75, i, 184; '79, 150; '80, 1882, 1883; '86, 290.

In 1887 Capt. Quinn proposed an extension of the dredged area and of the breakwater, '87, 1954.

Surveys.**MAPS.**

'81, 2032; '85, 1950; '87, 1954.

GRAND MARAIS, MICH., HARBOR OF REFUGE AT.—IMPROVEMENT OF.

(Continued from Vol. I, p. 231.)

Appropriations.

1880.....	\$10,000, '80, 1902.
1881.....	20,000, '81, 2038.
1882.....	40,000, '82, 2117.
1884.....	35,000, '84, 1833.
1886.....	26,250, '86, 1649.

Total..... 131,250

1888..... 50,000, act of August 11, 1888.

Commerce.

Necessity for harbor of refuge, '81, 2043.

Contracts.

1882. C. S. Baker, for labor and material for pier construction, and for dredging, at 25 cents per cubic yard, '83, 1636.

1884. J. H. Gillett, for superstructure and pier extension, '85, 1974.

1886. C. Southerland, for pier extension, '87, 1999.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 203; '81, 273, 2053; '82, 267; '83, 276; '84, 275; '85, 298; '86, 292; '87, 258.

GRAND MARAIS, MICH., HARBOR OF REFUGE AT—Continued.**Engineers—Continued.****BOARD OF ENGINEERS.**

Convened at Marquette, Mich., July 18, 1881, by S. O. No. 14, to report upon a plan for a harbor of refuge near Grand Marais, Mich., '81, 2050. (Lieut. Col. Comstock and Majs. Weitzel and Robert.)

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert, 1880-'83. Reports, '80, 1902; '81, 2038; '82, 2117.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1635.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1831; '85, 1973.

Capt. C. E. L. B. Davis, 1886-'— . Reports, '86, 1646; '87, 1999.

ASSISTANT.

L. Y. Schermerhorn. Report, '81, 2041, 2049.

Operations.

1882-'83. 26 cribs built and 5 sunk; 12,029 cubic yards of material dredged; construction of inspector's house completed, '83, 1635.

1883-'84. 9 cribs sunk in extension of west pier; construction of east pier begun by sinking 600 linear feet of crib-work; entire work riprapped and decked; 13,075 cubic yards material dredged; breach through sand-spit closed with brush and stone, '84, 1831.

1884-'85. 500 linear feet superstructure completed and west pier extended 50 feet, '85, 1973.

1885-'86. West pier extended 250 linear feet and east pier 150 feet; 100 linear feet superstructure on west pier completed; 200 linear feet pile-pier constructed by hired labor, '86, 1647.

1886-'87. Preparations for extension of west pier; 200 linear feet of west pier repaired; total amount of work accomplished, '87, 1999, 2000.

Plans.

By Lieut. Col. Robert, 1881, for (1) the construction of an artificial entrance, by cutting through the west spit near its western extremity at estimated costs of \$425,535, \$502,425, \$508,887, \$511,445; (2) for improvement of natural entrance at estimated costs of \$561,506, \$625,526, \$683,020, \$667,040, \$595,034, \$659,054, \$661,980, \$726,000, '81, 2045, 2046, 2047, 2048.

Private and Corporate Work.

Channel dredged in 1884, deepened by private enterprise, '84, 1831.

Projects.

By Board of Engineers, 1881, for the formation of a harbor of refuge at Grand Marais, Mich., by access to the bay through two parallel piers 1,550 and 1,960 feet in length, respectively, with a dredged channel between them of 500 feet width and 20 feet depth at its lake end, and 300 feet width and 18 feet depth at its harbor end. Estimated cost, \$450,000, '81, 2053; '87, 1999.

Surveys.

Made, 1880, under direction of Col. Robert, '81, 2039.

MAPS.

'81, 2040.

**GRAND PORTAGE AND WANS-WAU-GOISING BAY, MINN.—
EXAMINATION FOR HARBOR OF REFUGE AT.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 247; '82, 266.

ENGINEER IN CHARGE.

Capt. C. J. Allen. Report, '82, 2110.

Physical Characteristics.

Locality described, '82, 2110.

Plans.

In 1882 Capt. Allen estimated that a harbor of refuge at Grand Portage Bay would cost \$111,677 and at Wans-wau-goising Bay \$91,807, but that there was no present commercial requirement for such harbors at either locality, '85, 2111.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Allen, '85, 2110.

GRAND RIVER BELOW GRAND RAPIDS, MICH.—IMPROVEMENT OF.

Appropriations.

1881..... \$10,000, '81, 2225.
1882..... 15,000, '82, 2312.
1884..... 25,000, '84, 1987.

Contracts.

1882. Squier & White, for dredging, at \$6 per hour, '83, 1886.
1885. E. Finch, for dredging, at 25 cents per cubic yard, '85, 2082.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 221; '81, 294, 300; '82, 289; '83, 296; '84, 298; '85, 330; '86, 314; '87, 282, 286.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1880-'82. Report, '81, 2224, 2225.

Maj. D. P. Heap, 1882-'84. Reports, '82, 2311; '83, 1826.

Capt. D. W. Lockwood, 1884-'— Reports, '84, 1986; '85, 2081; '86, 1767; '87, 2193, 2206.

Operations.

1881-'82. 7,267 cubic yards material dredged; two lighters built, '82, 2311.

1882-'83. 6,172 cubic yards bowlders and 1,035 cubic yards clay dredged, '83, 1826.

1883-'84. 18,029 cubic yards material dredged, '84, 1987.

1884-'85. 14,112 cubic yards material dredged, '85, 2081.

1885-'86. 60,176 cubic yards sand, gravel, and clay, and 1,707 cubic yards bowlders removed; cleaning the channel to a point 8 miles below mouth of Ganoe's Canal at Grand Rapids, '86, 1767.

1886-'87. 6,158 cubic yards dredged from vicinity of Haire's Bar, '87, 2194.

Plans.

In 1887 Capt. Lockwood did not consider the river worthy of improvement, '87, 2207.

Projects.

By Maj. Harwood, 1881, for excavation of channel 100 feet wide and 4 feet deep at low water from Grand Rapids to deep water. Estimated cost, \$25,000, '81, 2224.

Increased by Maj. Heap, in 1882, to \$35,000, '82, 2311, 2312.

In 1887 Capt. Lockwood did not consider the river worthy of improvement, '87, 2207.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. Harwood, '81, 2225.

Special surveys to cover localities embracing shoals, '85, 2081.

Examination ordered by act of August 5, 1886. Made under direction of Capt. Lockwood, '87, 2206.

GRAND RIVER HARBOR, MICH. (See GRAND HAVEN HARBOR.)

GRAND RIVER HARBOR, OHIO—IMPROVEMENT OF.

(See FAIRPORT HARBOR, OHIO, IMPROVEMENT OF.)

GRAND RIVER, MO. (See BRUNSWICK, MO.)

GRAND TRAVERSE BAY—WITH A VIEW TO CONNECTING IT WITH TORCH LAKE, NEAR EASTPORT, MICH., EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 286.

ENGINEER IN CHARGE.

Capt. D. W. Lockwood, 1887. Report, '87, 2210.

GRAND TRAVERSE BAY—Continued.**Physical Characteristics.**

Description of the bay, '87, 2211.

Plans.

In view of the purely local nature of the improvement and the great cost of the same Capt. Lockwood reports the locality as unworthy of improvement, '87, 2211.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Lockwood, '87, 2210.

GRASS RIVER AT MASSENA, N. Y.—IMPROVEMENT OF.**Appropriations.**

1882..... \$3,000, '83, 1956.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 233; '81, 320; '83, 323; '84, 327; '85, 353; '86, 347; '87, 313.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1880-'83. Report, '81, 2457.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1956; '84, 2154.

Maj. M. B. Adams, 1885-'— . Reports, '85, 2296; '86, 1898; '87, 2396.

ASSISTANT.

F. T. Hampton. Report, '81, 2458.

Operations.

No operations yet undertaken, '87, 2396.

Projects.

By Maj. McFarland, 1881, for improvement of Grass River from mouth to Haskell's Wharf by dredging channel 4 feet deep at low water. Estimated cost, \$12,000, '81, 2458.

Increased, 1885, \$7,000, '85, 2297.

Increased, 1886, \$1,600, '86, 1899; '87, 2396.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. McFarland, '81, 2457.

GRAY'S HARBOR, WASH.—SURVEY OF ENTRANCE TO.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 332; '82, 324.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '82, 2722.

ASSISTANT.

R. A. Habersham. Report, '82, 2723.

Physical Characteristics.

Locality described, '82, 2723.

Plans.

In 1882 Capt. Powell considered that no present improvement of the entrance was necessary, '82, 2723.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Powell, '82, 2722.

GREAT BAY, N. H. (See PISCATAQUA RIVER, N. H. AND ME.)**GREAT KANAWHA RIVER, W. VA. (See KANAWHA RIVER, GREAT.)**

GREAT PECONIC BAY, N. Y. (See PECONIC RIVER, N. Y.)**GREAT PEE DEE RIVER, S. C.** (See PEE DEE RIVER, GREAT.)**GREAT SODUS HARBOR, N. Y.** (See SODUS HARBOR, GREAT.)**GREAT WICOMICO RIVER, VA.** (See WICOMICO RIVER, GREAT.)**GREEN BAY HARBOR, WIS.—IMPROVEMENT OF HARBOR AT.**

(Continued from Vol. I, p. 234.)

Appropriations.

1866-'79	\$229,550
1880	6,000, '80, 1906.
1881	5,000, '81, 2070.
1882	20,000, '82, 2133.
1884	10,000, '84, 1845.
1886	7,000, '86, 1659.

Total	277,550
1888	10,000, act of August 11, 1888.

Contracts.

1880. Green Bay Dredge and Pile Driver Company, for dredging, at 26 cents per cubic yard, '80, 1906.
 1881. Green Bay Dredge and Pile Driver Company, for dredging, at 19 cents per cubic yard, '81, 2070.
 1882. N. G. Dodge, for dredging, at 17 cents per cubic yard, '83, 1654.
 1885. Green Bay Dredge and Pile Driver Company, for dredging, at 26 cents per cubic yard, '85, 1987.
 1887. G. Denis, for stone, at \$3.74 per cord, '87, 2012. Shadbolt, Boyd & Co., for iron, '87, 2013. Leatham & Smith, for timber, '87, 2013.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 203; '81, 274; '82, 270; '83, 279; '84, 278; '85, 302; '86, 296; '87, 261.

ENGINEERS IN CHARGE.

- Lieut. Col. H. M. Robert, 1875-'83. Reports, '80, 1905; '81, 2069; '82, 2133.
 Capt. F. A. Hinman, 1883-'84. Report, '83, 1653.
 Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1844; '85, 1987.
 Capt. C. E. L. B. Davis, 1886-'— . Reports, '86, 1658; '87, 2012.

ASSISTANT.

L. Y. Schermerhorn. Report, '—, 1, 2071.

Operations.

- 1879-'80. 12,571 cubic yards material dredged, '80, 1905.
 1880-'81. 26,345 cubic yards material dredged, '81, 2069.
 1881-'82. 18,002 cubic yards material dredged, '82, 2133.
 1882-'83. 43,524 cubic yards material dredged, '83, 1653.
 1883-'84. 52,211 cubic yards material dredged, '84, 1844.
 1884-'85. 49,402 cubic yards material dredged, '85, 1987.
 1885-'86. 11,500 cubic yards material dredged; 705 linear feet of east revetment and superstructure repaired, '86, 1658.
 1886-'87. Repair of east revetment at Grassy Island, '87, 2012.

Physical Characteristics.

Table of weekly fluctuations of water surface, '81, 2071.

GREEN BAY HARBOR, WIS.—Continued.**Projects.**

By Maj. Houston, 1872, for dredging cut so as to widen and deepen it to 14 feet throughout, requiring the removal of about 175,000 cubic yards of material. Estimated cost, \$50,000, '72, 31, 116; '73, 198; subsequently increased to \$75,000, '74, i, 38, 140.

After an aggregate of appropriations, amounting to \$235,550, Maj. Robert, in 1881, proposed dredging channel 200 feet wide and 14 feet deep revised datum, from mouth of Fox River to deep water in Green Bay, requiring the removal of 240,000 cubic yards. Estimated cost, \$72,000, '81, 2070.

Surveys.

Survey made, 1881, '81, 2069.

GREENBRIAR RIVER, W. VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 288.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill. Reports, '77, 709; '85, 1866.

ASSISTANTS.

Lieut. T. Turtle. Report, '77, 709.

W. P. Smith. Report, '85, 1867.

Physical Characteristics.

River described, '85, 1867.

Plans.

In 1884 Lieut. Col. Craighill did not consider that the advantages resulting from the improvement of the river would be sufficient to justify the cost, '85, 1867.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. Craighill, '85, 1866.

GREENPORT HARBOR, N. Y.—IMPROVEMENT OF.**Appropriations.**

1882.....	\$10,000, '83, 528.
1884.....	10,000, '84, 658.
1886.....	5,000, '86, 659.
1888.....	5,000, act of August 11, 1888.

Commerce.

Present tonnage and probable increase of commerce resultant upon improvement, '82, 636.

Contracts.

1883. Luce & Hoskins, for stone, at \$1.59 per ton, '83, 528.
 1884. C. H. Edwards, for stone, at \$1.38 per ton, '85, 664.
 1886. J. V. Luce, for stone, at \$1.17 per ton, '87, 632.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 97; '82, 97; '83, 92; '84, 99; '85, 89; '86, 90; '87, 54.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1881-'83. Report, '82, 635.

Lieut. Col. W. McFarland, 1863-'86. Reports, '83, 527; '84, 658; '85, 664.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 659; '87, 630.

ASSISTANT.

H. N. Babcock. Report, '82, 635.

Operations.

1882-'83. 939 tons stone delivered, and 45 tons placed in position, completing 25 linear feet of dike, '83, 528.

1883-'84. 4,047 tons of stone delivered in breakwater, completing same to 805 feet, '84, 658.

1884-'85. 6,387 tons stone placed in the work, increasing its length 428 linear feet, '85, 664.

1885-'86. No operations, '86, 659.

1886-'87. 1,596 tons of stone placed in work, extending its length 92 feet, '87, 631.

GREENPORT HARBOR, N. Y.—Continued.**Physical Characteristics.**

Mean rise and fall of tide at Greenport, '82, 636.

Projects.

By Maj. Barlow, 1882, for construction of a rubble-stone breakwater upon Joshua Point Shoal, off Joshua Point, to cover Greenport Harbor anchorage from east and northeast storms, and to prevent further shoaling of harbor by transfer of material from point and shoal above mentioned. Estimated cost of breakwater, extending to 18-foot curve, \$46,000, '82, 635; '87, 630.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Maj. Barlow, '82, 635.

MAPS.

'83, 528; '85, 664.

GREEN RIVER, N. C.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 164.

ENGINEER IN CHARGE.

Capt. F. A. Hinman. Report, '85, 1046.

Physical Characteristics.

River discharge, '85, 1046.

Plans.

In 1884 Capt. Hinman did not consider the river worthy of improvement, '85, 1048.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Hinman, '85, 1046.

GREEN RIVER AND TRIBUTARIES, KY.—SURVEY OF.

(Continued from Vol. I, p. 236.)

[\$135,000 appropriated by act of August 11, 1888; purchase of locks, dams, etc.]

Commerce.

See PRIVATE AND CORPORATE WORK.)

Engineers.**(BOARD OF ENGINEERS.)**

Report of Board of 1886 upon the commercial value and importance of the works of the Green and Barren River Navigation Company, '87, 1903. (Majs. King, Stickney, and Mackenzie.)

CHIEF OF ENGINEERS.

Reports, '80, 195; '85, 292; '87, 249.

ENGINEERS IN CHARGE.

Maj. W. E. Merrill. Report, '80, 1799.

Capt. J. C. Post. Report, '85, 1904.

ASSISTANTS.

R. H. Fitzhugh. Report, '80, 1802.

A. L. Duval. Report, '85, 1910.

Legislation.

Green and Barren River Navigation Company chartered by State of Kentucky, '80, 1799.

Effort and failure to repeal act, '80, 1801.

Acts of incorporation, '80, 1822; '85, 1907.

Plans.

By Maj. Merrill, 1880, for slack-water navigation on Green and Big Barren rivers by means of locks and dams. Estimated cost from \$334,805 to \$393,184, '80, 1801, 1818. Since the State virtually closed the river by its charter to the navigation company it is not considered as entitled to aid from the General Government, '80, 1801.

Report of Capt. Post on the condition of the Green and Barren rivers, '85, 1904.

Report of Board of Engineers, 1886, on the commercial value and importance of, '87, 1903.

GREEN RIVER AND TRIBUTARIES, KY.—Continued.**Physical Characteristics.**

Description of ores and coals on Green River, '80, 1808, 1810, 1812.

Distances and elevations, '80, 1817.

Private and Corporate Work.

The Green River, under the control of a company chartered by the State of Kentucky, '80, 1799. Existing dams on river, '80, 1816. Rates of toll, '80, 1800.

In accordance with the requirements of the act of July 5, 1845, Capt. Post reports on the condition of Green and Barren rivers, with estimated cost of relieving the same from incumbrance, so as to render them free to commerce, '85, 1904, 1914.

Report of Board of Engineers, 1886, on the commercial value and importance of the works of the navigation company, '87, 1903.

Surveys.

1879, by R. H. Fitzhugh, '80, 1802.

GUTTENBURGH, IOWA. (See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)**GUYANDOTTE RIVER, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 236.)

Appropriations.

1878-'79	\$3,000
1880	2,000, '80, 1831.
1881	3,500, '81, 1987.
1882	2,000, '82, 1957.
1884	2,000, '84, 1754.

Total

12,500

1888

2,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 196; '81, 264; '82, 259; '83, 267; '84, 266; '85, 290; '86, 285; '87, 242.

ENGINEERS IN CHARGE.

Maj. J. W. Cuyler, 1880-'83. Reports, '80, 1830; '81, 1986; '82, 1955.

Capt. J. C. Post, 1883-'87. Reports, '83, 1570; '84, 1753; '85, 1889; '86, 1622.

Lieut. Col. W. E. Merrill, 1887-'—. Report, '87, 1827.

ASSISTANT.

E. A. Chase. Reports, '80, 1831; '81, 1967.

Operations.

All operations by hired labor.

1879-'80. 800 cubic yards of sand dredged; 300 cubic yards solid rock removed; 3,348 snags, stumps, and trees cut and removed, '80, 1831.

1880-'81. 1,345 snags removed; 965 cubic yards rock removed, '81, 1967.

1881-'82. Improvement of channel continued, '82, 1956.

1882-'83. 600 cubic yards solid rock removed; 122 stumps and trees removed; 1,030 linear feet brush and rock dams built, '83, 1571.

1883-'84. 426 cubic yards solid rock and 85 cubic yards loose rock and gravel removed, '84, 1753.

1884-'86. No operations, '85, 1889; '86, 1622.

1886-'87. Removal of Rogers's Mill-dam, '87, 1827.

Projects.

By Maj. Merrill, 1878, to remove snags, rock, and other obstructions. Estimated cost, \$10,000, '75, i, 749; '78, 108; '79, 1352; '80, 196.

By Capt. Post, 1884, for removal of snags, rock, and obstructions from mouth to Logan Court-House, 81 miles, also for purchase and removal of Rogers's and Peck's mill-dams. Estimated cost, \$10,000, '84, 1753.

*Reappropriated by act of 1888, '86, 1622. List of appropriations previous to 1880, '83, 1571.

HAMPTON RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 236.)

Appropriations.

1878-'79..... \$12,000.

List of appropriations previous to 1880, '80, 779.

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 115.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1874-'80. Report, '80, 779.

Operations.

History of work, '80, 779.

1879-'80. 66,328 cubic yards material dredged; project completed, '80, 780.

Projects.

By S. T. Abert, 1875, for cutting channel 150 feet wide by 9 feet deep through bar at mouth of river. Estimated cost, \$15,757, '75, ii, 153; '78, 72. Project completed in 1880, '80, 780.

HANDBOROUGH, MISS.—EXAMINATION OF BACK BAY AT.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 214.

ENGINEER IN CHARGE.

Maj. A. N. Damrell. Report, '85, 1373.

Plans.

In 1884 Maj. Damrell considered that the bay was not worthy of improvement, as its cost would probably exceed \$140,000, '85, 1374.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Damrell, '85, 1373.

HANNIBAL, MO. (See MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER.)

HARBOR OF REFUGE AT BEAVER BAY, MINN. (See BEAVER BAY, MINN.)

HARBOR OF REFUGE, LAKE HURON. (See SAND BEACH, LAKE HURON.)

HARBOR OF REFUGE ON LAKE PEPIN AT LAKE CITY, MINN., AND STOCKHOLM, WIS. (See LAKE PEPIN, MISSISSIPPI RIVER.)

HARBOR OF REFUGE AT MILWAUKEE, WIS. (See MILWAUKEE BAY, WIS.)

HARBOR OF REFUGE ON THE PACIFIC COAST—IMPROVEMENT OF.**Appropriations.**

1879..... \$150,000, '81, 2621.

Commerce.

List of marine disasters, '81, 2637, 2668.

Interest of commerce in a harbor of refuge, '81, 2640, 2698.

Engineers.**CHIEF OF ENGINEERS.**

Report, '81, 333, 2679.

BOARD OF ENGINEERS.

Board of Engineers for the Pacific coast report upon proposed harbor of refuge between the Straits of Fuca and San Francisco, '81, 2621, 2681. (Lieut. Cols. Stewart, Williamson, and Mendell, and Maj. Gillespie.)

Minority report of Col. Williamson, '81, 2651.

Physical Characteristics.

Description of north Pacific coast, '81, 2626.

Storms of the coast, '81, 2634.

Description of Port Orford, '81, 2647.

Plans.

Comparison of sites, '81, 2643, 2647.

Board of Engineers recommended Port Orford as site of harbor of refuge, '81, 2648, 2694.

Minority report, Col. Williamson, '81, 2651.

HARBOR OF REFUGE, PORTAGE LAKE AND LAKE SUPERIOR SHIP-CANAL. (See PORTAGE LAKE AND LAKE SUPERIOR SHIP-CANAL.)**HARBOR OF REFUGE AT SANDY BAY, CAPE ANN, MASS.**
(See SANDY BAY, MASS.)**HARLEM RIVER, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 238.)

Appropriations.

1874-'79..... \$420,000

1888..... 70,000, act of August 11, 1888.

No appropriations made since 1879. In 1886 \$400,000 was on hand from the appropriations of 1878-'79, which was held until right of way is secured free of cost to United States, '78, 55; '79, 385; '86, 95; '87, 58.

Right of way secured in 1887, '87, 671, 674.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 82; '81, 100, 108; '82, 101; '83, 96; '84, 103; '85, 93; '86, 94; '87, 58.

ENGINEERS IN CHARGE.

Col. J. Newton, 1874-'84. Reports, '80, 507; '81, 631; '82, 656; '83, 543.

Capt. J. Mercur, 1884-'85. Report, '84, 704.

Lieut. Col. W. McFarland, 1885-'— . Reports, '85, 674; '86, 672; '87, 665.

Legislation.

Delay in securing right of way, '80, 507; '86, 674; '87, 668.

Acts of State of New York relating to right of way, '87, 677.

Operations.

1878-'86. No operations from lack of right of way, '87, 58, 668.

1886-'87. Right of way obtained May, 1887, '87, 58, 674.

Plans.

By Col. Newton, 1882, for channel through Harlem Kills 300 feet wide and 3,400 feet long. Estimated cost for 18-foot depth, \$3,488,400; 15-foot depth, \$2,204,409; 12-foot depth, \$1,161,225, '82, 657.

HARLEM RIVER, N. Y.—Continued.**Plans—Continued.**

By Col. Newton, 1884, for channel 350 feet wide and 15 feet deep from the Hudson to Harlem River at Morris Dock, opposite Sherman's Creek. Estimated cost, (1) via Dyckman's Creek, \$2,091,634; (2) via King's Bridge, \$3,038,698; (3) via Sherman's Creek, \$3,026,076; '84, 765.

History of plans, '87, 666.

Projects.

By Col. Newton, 1875, for a channel 15 feet deep at mean low water from Randall's Island, by way of Spuyten Duyvil Creek, to the Hudson River, including the removal of rock, obstructions around piers of High Bridge, excavation of canal prism, dredging, and revetment, the width of channel to be 400 feet, except through Dyckman's Meadow, where it is reduced to 350 feet. Estimated cost, \$2,100,000, '75, ii, 236, 237; '84, 705; '85, 676. For the improvement of Harlem River between this proposed channel and its mouth, \$600,000, '75, ii, 237; '85, 676. Aggregate estimated cost of entire improvement, \$2,700,000, '75, ii, 237; '85, 676; '86, 674; '87, 668.

History of project, '87, 666.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Col. Newton, '82, 656.

MAPS.

'82, 656.

HARLOWE RIVER, N. C. (See NEW BERN TO BEAUFORT, N. C., INLAND LINE OF NAVIGATION BETWEEN.)**HARRISECKET RIVER, ME.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '82, 77.

ENGINEER IN CHARGE.

Col. G. Thom. Report, '82, 530.

ASSISTANT.

A. C. Both. Report, '82, 531.

Plans.

By Col. Thom, 1881, for the formation of a dredged channel from Weston Point to Freeport Landing 60 feet wide and 12 feet deep at high water, with a basin at Freeport 180 feet wide. Estimated cost, \$13,000, '82, 531.

Surveys.

Ordered by act of March 3, 1881. Made under direction of Col. Thom, '82, 530.

HELL GATE, N. Y. (See EAST RIVER, N. Y.)**HEMPSTEAD HARBOR AND BAY, N. Y.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 108; '84, 122.

ENGINEERS IN CHARGE.

Col. J. Newton. Report, '81, 668.

Maj. G. L. Gillespie. Report, '84, 764.

ASSISTANT.

R. H. Talcott. Report, '81, 669.

Commerce.

Small amount of commerce to be benefited, '84, 764.

HEMPSTEAD HARBOR AND BAY, N. Y.—Continued.**Plans.**

- By Col. Newton, 1881, for improvement by separating the inner from the outer bay by a dam, and regulating ingress and egress by means of a lock. Estimated cost, \$440,000. Not recommended, '81, 668.
- By construction of a dike 7,500 feet in length from "Bar Beach" in a southerly direction to Hick's Wharf and dredging. Estimated cost, \$163,200, '81, 668.
- By construction of 2,500 linear feet of diking from bay entrance to steam-boat dock and dredging. Estimated cost, \$83,375, '81, 671.
- In 1884 Maj. Gillespie did not consider Hempstead Bay worthy of improvement nor the work a public necessity, '84, 764.

Surveys.

- Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Newton, '81, 668. Of Hempstead Bay ordered by act of August 2, 1882. Made under direction of Maj. Gillespie, '84, 764.

HENNEPIN CANAL—SURVEY FOR.

(Continued from Vol. I, p. 239.)

Appropriations.

- 1882..... \$30,000, '83, 290.
- 1886..... 15,000, '86, 457.

Commerce.

- Commercial necessity for canal, '83, 1790; '86, 1738.
- Effect of water transportation competition rates, '83, 1781.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '83, 239; '84, 291; '85, 314; '86, 309, 1708; '87, 275, 2127.

BOARD OF ENGINEERS.

- Of 1886 to report upon the Hennepin Canal. Report, '87, 2137-2141.
- (Lieut. Cols. Comstock and Poe and Maj. Post.)

ENGINEERS IN CHARGE.

- Maj. W. H. H. Benyaurd. Reports, '83, 1754, 1788; '84, 1950; '85, 2056; '86, 1733.

- Maj. T. H. Handbury. Report, '86, 1711, 1735.

ASSISTANTS.

- H. B. Herr. Report, '83, 1763.
- G. Y. Wisner. Report, '83, 1773.
- G. A. M. Liljencrantz. Report, '86, 1719.

Legislation.

- Relating to survey, '83, 1755.
- Form for act ceding Illinois and Michigan Canal to United States, '83, 1787.

Plans.

- By Maj. Benyaurd, 1882, for a canal between Hennepin, on the Illinois River, and vicinity of Watertown, on the Mississippi River, canal prism to be 80 feet wide at water-line and 7 feet deep, lock 170 feet long and 30 feet wide.
- By the Marais d'Osier route, 65 miles in length. Estimated cost, \$5,811,367.
- By Watertown route, 65 miles in length. Estimated cost, \$7,207,646.
- By Rock Island route, 74½ miles in length. Estimated cost, \$6,672,890, '83, 1757, 1758, 1762, 1772, 1788; '86, 1709.
- Revised in 1885 to \$6,709,536, '86, 1709.
- Preference given to Marais d'Osier route, '83, 1760, 1761; '86, 1710, 1715, 1734; '87, 2140.
- In 1885 additional surveys were made for the Watertown and Rock Island routes and the following estimates submitted by Capt. Handbury:
- Watertown route (via Penney's Slough), 65 miles in length, \$6,306,552, '86, 1709, 1713, 1722.
- Rock Island route (via Penney's Slough and Rock River), 77 miles in length, \$6,554,052, '86, 1709, 1713, 1722.
- Rock Island route (via Green River, revised), 74½ miles in length, \$6,709,536, '86, 1709, 1713, 1722.
- The Chief of Engineers suggests the adoption of Rock Island route, '86, 1710.
- Advantages of Rock Island route, '86, 1710, 1723, 1732, 1748.
- The Board of Engineers of 1886 preferred the Marais d'Osier route, '87, 2140.

Private and Corporate Work.

- Description of Illinois and Michigan Canal, '83, 1774.

HENNEPIN CANAL—Continued.**Surveys.**

Ordered by act of August 2, 1882, '83, 290. Made under direction of Maj. Benyaurd, 1883, '83, 1754, 1756.

History of surveys previous to 1882, '83, 1755.

Additional surveys in 1885, '86, 1708, 1728.

Maps.

Of Hennepin, Illinois and Michigan Canals, '87, 2171.

HERO ISLANDS, N. Y. (See LAKE CHAMPLAIN AT.)**HIAWASSEE RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 239.)

Appropriations.

1876-'79	\$23,000
1880	3,000, '80, 1679.
1881	1,500, '81, 1830.
1882	1,500, '82, 1818.
1884	2,500, '84, 1650.
1886	2,500, '86, 1520.

Total	34,000
1888	1,000, act of August 11, 1888.

Encroachments.

Obstruction to navigation from railroad bridge without draw, '87, 1754.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 186; '81, 252; '82, 245; '83, 253; '84, 254; '85, 276; '86, 267; '87, 232.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1877-'86. Reports, '80, 1874; '81, 1860; '82, 1847; '83, 1493; '84, 1649; '85, 1764.

Lieut. Col. J. W. Barlow, 1886-'— . Reports, '86, 1519; '87, 1754.

Operations.

1879-'80. 581 cubic yards rock quarried, 98 cubic yards rock blasted, 656 cubic yards placed in dams, '80, 1679.

1880-'81. 157 cubic yards rock blasted, 230 cubic yards rock quarried, 500 cubic yards put into dams, '81, 1860.

1881-'82. 788 cubic yards bowlders removed from river and placed in dams, '82, 1847.

1882-'83. 65 cubic yards rock, 219 cubic yards bowlders, and 82 snags removed from channel; 104 cubic yards riprap dam built, '83, 1493.

1883-'85. No operations, '84, 1649; '85, 1764.

1885-'86. 64 cubic yards material removed from channel, 55 snags and trees removed, 432 cubic yards stone quarried, 287 cubic yards riprap dam built, '86, 1520.

1886-'87. Removal of snags, gravel, and rock, and construction of dams at Mathews Shoal, Canefield Reefs, Bunker Hill Shoal, and Magill's Island, '87, 1754.

Projects.

By Lieut. Col. McFarland, 1874, for a channel 40 feet wide and 2 feet deep at low water from mouth to Savannah, for a distance of 33 miles. Estimated cost, \$20,000, '75, i, 810-813. Re-estimate, \$30,000, '78, 762; '79, 140, 1269. Increased by Maj. King in 1882 to \$34,000, '82, 1848, and in 1885 to \$36,500, '85, 1764; '87, 1755.

HIAWASSEE, TENNESSEE, AND SAVANNAH RIVERS—CANAL CONNECTING.

(See CANAL CONNECTING HIAWASSEE, TENNESSEE, AND SAVANNAH RIVERS.)

HINGHAM HARBOR, MASS.—SURVEY AND IMPROVEMENT OF.

(Continued from Vol. I, p. 240.)

Appropriations.

1875..... \$10,000, '75, i, 119; '87, 521.
 1886..... 6,000, '87, 522.
 1888..... 5,000, act of August 11, 1888.

Contracts.

Boyn-ton Brothers, for dredging, at 92 cents per cubic yard, and rock removal, at \$27 per cubic yard, '87, 522.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 67; '87, 28.

ENGINEERS IN CHARGE.

Capt. C. W. Raymond. Report, '85, 553.

Lieut. Col. G. L. Gillespie. Report, '87, 520.

ASSISTANT.

H. F. Bothfeld. Report, '85, 555.

Operations.

1875-'76. 25,160 cubic yards of earth and 83 cubic yards of rock removed, '76, i, 168; '87, 521.

1876-'86. No operations, '87, 521.

1886-'87. 1,247 cubic yards gravel and 143 cubic yards of rock removed, '87, 521.

Physical Characteristics.

Description of harbor, '84, 563; '87, 520.

Projects.

The project of 1874 proposed the formation of a channel 100 feet wide and 8 feet deep at low water, by dredging and rock removal, '75, ii, 410, 418; '85, 553. This work was accomplished in 1875-'76, '76, i, 168.

In 1885 the project was modified so as to deepen the improved channel to 10 feet and remove a mid-channel ledge between Chandler's and Ragged Islands, '85, 555, 557; '87, 521.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Capt. Raymond, '85, 555.

HOLMES CREEK, FLA.—SURVEY OF.

(Continued from Vol. I, p. 240.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1308.

ASSISTANT.

H. Haines. Report, '82, 1308.

Plans.

By Capt. Damrell, 1881, for removal of snags, trees, and similar obstructions from the mouth of the river to a point 35 miles above. Estimated cost, \$5,000, '82, 1308.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Capt. Damrell, '82, 1308.

HOLSTON RIVER, TENN. AND VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 190; '81, 258; '85, 279; '87, 236.

ENGINEERS IN CHARGE.

Maj. W. B. King. Reports, '81, 1878; '85, 1773.

Lieut. Col. J. W. Barlow. Report, '87, 1772.

ASSISTANTS.

W. G. Sanborn. Report, '81, 1880.

C. A. Locke. Report, '87, 1773.

HOLSTON RIVER, TENN. AND VA.—Continued.**Physical Characteristics.**

Description of river, '81, 1880; '87, 1774.

Plans.

By Maj. King, 1881, for a channel from 60 to 80 feet wide and 1½ feet deep at extreme low water, for a distance of 171 miles, from Saltville to North Fork junction, to be secured by rock excavation, wing-dam construction, and the removal of trees and snags. Estimated cost, \$242,913, '81, 1879, 1883, 1885.

By Lieut. Col. Barlow, for an improved channel 100 feet wide and 20 inches deep at low water, from the Forks to Knoxville, a distance of 154 miles, by removal of obstructions and contraction of channel by wing-dams. Estimated cost, \$347,000, '87, 1773.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. King, '81, 1878.

Examination ordered by act of August 5, 1886. Made under direction of Lieut. Col. Barlow, '87, 1772.

HORN ISLAND PASS, MISS.—IMPROVEMENT OF.

(See also PASCAGOULA HARBOR, MISS.)

Appropriations.

1884..... \$5,000, '85, 1362.

The act of August 5, 1886, directs that the appropriation be applied to improvement of Pascagoula River, '86, 210.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 186; '85, 212; '86, 210.

ENGINEER IN CHARGE.

Maj. A. N. Damrell. Reports, '82, 1324; '85, 1361; '86, 1206.

ASSISTANT.

T. L. Harrison. Report, '82, 1325.

Plans.

By Capt. Damrell, 1882, for a dredged channel through Horn Island Pass 100 feet wide and 21 feet deep, at an estimated cost of \$43,000, '82, 1324, 1325; '85, 1362.

Surveys.

Ordered by act of June 14, 1880. Made under the direction of Maj. Damrell, '82, 1324.

HOMOCHITTO RIVER, MISS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 225.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '85, 1429.

ASSISTANT.

C. D. Anderson. Report, '85, 1429.

Plans.

In 1884 Capt. Turtle did not consider the river worthy of improvement, '85, 1430.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Turtle, '85, 1429.

HOMOSASSA BAY, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 214.

ENGINEER IN CHARGE.

Maj. A. N. Damrell. Report, '85, 1373.

HOMOSASSA BAY, FLA.—Continued.**Plans.**

In 1884 Maj. Damrell considered that the improvement would cost from \$100,000 to \$180,000. Not recommended for improvement, '85, 1373.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Damrell, '85, 1373.

HORTON'S POINT, N. Y.—EXAMINATION FOR BREAKWATER AT.**Commerce.**

Necessity for harbors of refuge on Long Island Sound, '85, 701.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 95.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland. Report, '85, 701.

Plans.

In 1884 Col. McFarland considered that a harbor of refuge at this locality would cost not less than \$1,000,000, and that the selection of the site for such a harbor should be made only after careful study of the whole coast line, '85, 702.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Col. McFarland, '85, 701.

HOUSATONIC RIVER, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 240.)

Appropriations.

1870-79	\$89,000
1880.....	2,000, '80, 461.
1881.....	2,000, '81, 602.
1882.....	2,000, '82, 616.
1884.....	2,500, '84, 651.
1886.....	5,000, '86, 643.

Total..... 82,500

1888..... 35,000, act of August 11, 1888.

Statement of appropriations, '87, 609.

Contracts.

1881. J. M. Seward, for dredging, at 16 and 20 cents per cubic yard, '81, 602. J.

McDermott, for dredging, at 23 cents per cubic yard, '82, 617.

1885. Lewis & Merwin, for dredging, '86, 643.

1886. F. H. Smith, for removal of Davis Rock and jetty, '87, 609.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 79; '81, 93; '82, 94; '83, 90; '84, 96; '85, 85; '86, 85; '87, 48.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 460; '81, 601; '82, 615.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 518; '84, 650; '85, 649.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 642; '87, 606.

Physical Characteristics.

Description of river, '86, 642.

Projects.

In 1871 Maj. G. K. Warren proposed the formation of a channel 100 feet wide and 7 feet deep from Derby to Long Island Sound by dredging and the construction of jetties, also the formation and protection of a dredged channel at the mouth by a breakwater from Milford Beach. Estimated cost, \$404,961, '71, 781, 783, 786; '86, 642; '87, 606.

In 1879 Maj. Barlow proposed a riprap jetty in place of the previously proposed breakwater, '79, 345; '87, 607.

In 1884, after an aggregate appropriation of \$71,200, Lieut. Col. McFarland proposed the removal of Drew's Rock and the construction of the riprap jetty as per previous projects. Estimated cost, \$30,000, '84, 650, 651; '87, 607.

HOUSATONIC RIVER, CONN.—Continued.**Projects—Continued.**

In 1877 Lieut. Col. Houston recommended the extension of a riprap breakwater from Milford Beach to the 12-foot curve of depth, and the dredging of a channel 7 feet deep and 200 feet wide through the bar at the mouth of the river, and thence to Derby a channel 100 feet wide. Estimated cost, \$202,600, '87, 608.

Operations.

1879-'80. No operations, '80, 460.

1880-'81. 9,290 cubic yards sand dredged from channel, '81, 601.

1881-'82. 7,818 cubic yards material dredged from channel, '82, 616.

1882-'85. No operations, '83, 518; '84, 650; '85, 649.

1885-'86. 14,394 cubic yards material dredged, '86, 643.

1886-'87. 37,494 cubic yards dredged from bar at mouth of river without cost to the United States; 169 cubic yards rock removed from Drew's Rock, '87, 607.

Surveys.**MAPS.**

'82, 616; '86, 642; '87, 608.

HUDSON RIVER, N. Y. (BETWEEN NEW BALTIMORE AND TROY)—IMPROVEMENT OF.

(Continued from Vol. I, p. 242.)

Appropriations.

1834-79	\$1,372,288
1880.....	20,000, '80, 474
1881.....	15,000, '81, 619.
1882.....	10,000, '82, 643.
1884.....	30,000, '84, 699.
1886.....	26,250, '86, 669.

Total 1,473,538
 1888..... 75,000, act of August 11, 1888.
 Statement of appropriations, '87, 656.

Commerce.

Opposition of Schuyler Steam Tow-Boat Line to plan of improvements, '80, 480, 486; '85, 690.

Commercial statistics, '87, 657.

Contracts.

1881. Stanton & Doyle, rock removal, '82, 642, 644. W. D. Fuller, dike construction, '82, 642, 644.

1882. Luce & Hoskins, for riprap stone, '83, 528.

1886. J. B. Marshall & Co. and W. D. Fuller, for repair of dikes, '87, 657.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 81, 479, 480; '81, 97; '82, 97; '83, 93; '84, 101; '85, 94; '86, 92; '87, 56, 67.

BOARD OF ENGINEERS.

Convened at New York March 5, 1880, to report upon Gen. Newton's plan for improvement of the Hudson at New Baltimore, which, in the opinion of the Schuyler Steam Tow-Boat Company, would result in injury to the navigation of the river, '80, 480; '85, 690. (Col. Tower and Maj. Abbot.)

ENGINEERS IN CHARGE.

Col. J. Newton, 1866-'84. Reports, '80, 471, 488, 489; '81, 617; '82, 641; '83, 529; '85, 678.

Capt. J. Mercur, 1884-'85. Report, '84, 696.

Lieut. Col. W. McFarland, 1885-'— . Reports, '85, 677, 690; '86, 665; '87, 650.

ASSISTANT.

Lieut. J. H. Willard. Reports, '80, 475; '85, 696.

Operations.

Works of improvement prior to 1880, '85, 682; '86, 665.

1879-'80. Dikes at Donw's Point and Shad Island completed; east and west dikes at New Baltimore extended; upper section of dike between Barren Island and New Baltimore raised to high-water level; beacon crib built; 17,000 linear feet single pile-dike constructed; repairs to crib-dike at Hillhouse Island to west dike at Coeymans; 9,000 cubic yards material dredged, '80, 471, 472, 473, 477.

HUDSON RIVER, N. Y.—Continued.**Operations—Continued.**

- 1880-'81. Line of single piling at Staats extended 225 feet; repairs to dikes at Bath and Donw's Point; 9,348 cubic yards rubble-stone placed; 1,170 linear feet piling restored, '81, 618.
- 1881-'82. Removal of Austin's Rock commenced; dike construction under contract of 1881 nearly finished; repairs and filling to existing works, '82, 642.
- 1882-'83. Removal of Austin's Rock continued; 711 linear feet dike built; 115 linear feet crib-work built; repairs to high dike at Hillhouse, '83, 529, 530.
- 1883-'84. Removal of Austin's Rock nearly finished; 119,760 cubic yards material dredged by State authorities, '84, 696.
- 1884-'86. No operations, '85, 677; '86, 665.
- 1886-'87. Repair of dikes at New Baltimore, Roah Hook, and Coeymans, '87, 654.
- History of past operations, '87, 650.

Physical Characteristics.

Tidal rise of the Hudson at various points, '86, 667, 668; '87, 652.

Private and Corporate Work.

- Repairs to State dikes below Castleton and at Mull's Island, by State authorities, also dredging at the above places, and between Troy and Albany, '83, 530.
- Dredging by State authorities, '84, 696; '87, 654.

Projects.

By Col. Newton, 1886, for improvement of the Hudson between New Baltimore and Troy, a distance of 20 miles, by a navigable channel 11 feet deep at mean low water between New Baltimore and Albany, and 9 feet between Albany and Troy, to be secured by dikes and dredging. Estimated cost, \$862,297.75, '66, iv, 218, 219.

Revised in 1867 to \$984,304.47, '68, 718, 719; '87, 667. Increased in 1882 to cover repairs by \$78,000, '82, 643; '86, 667. For removal of rock, 1884, by Capt. Mercur, \$16,000, '84, 696. Increasing the estimated cost to \$1,078,304.47, '86, 667; '87, 651, 656.

From 1864 to 1886, inclusive, \$1,053,538 was appropriated.

In 1887 Lieut. Col. McFarland considered that \$255,000 would yet be required to complete the permanent works and make needed repairs to existing dikes, '87, 653, 655, 656.

Surveys.

Examination of rocks at Van Wies's Point; surveys and examinations at various points, '80, 475.

Of river between Troy and New Baltimore, by Lieut. Col. McFarland, 1884, '85, 695.

Between New Baltimore and Coxsackie, ordered by act of August 5, 1886, '87, 97.

MAPS.

'80, 484; '81, 618; '85, 692, 696.

HUDSON RIVER, N. Y.—EXAMINATION OF, FROM TROY TO MOUTH OF CANAL.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 96.

ENGINEER IN CHARGE.

Capt. J. Mercur. Report, '85, 71

ASSISTANT.

F. P. Rogers. Report, '85, 712.

Plans.

In 1884 Capt. Mercur did not consider this part of the river worthy of improvement, '85, 712.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Mercur, '85, 711.

HUDSON RIVER, N. Y.—INCLUDING SURVEYS BETWEEN ELLIS ISLAND AND CONSTABLE HOOK, N. J., IN FRONT OF JERSEY CITY AND HOBOKEN, AND EXAMINATION FROM WEEHAWKEN TO BERGEN POINT, N. J.

Commerce.

Commercial statistics, '81, 720; '84, 776.

Engineers.

CHIEF OF ENGINEERS.

Reports, '82, 116; '84, 122; '85, 115.

ENGINEER IN CHARGE.

Maj. G. L. Gillespie. Reports, '82, 719; '84, 774; '85, 790, 791.

ASSISTANT.

A. Doerflinger. Report, '82, 722.

Physical Characteristics.

Description of localities, '81, 719.

Deposits from dumping on Jersey Flats, '82, 720.

Comparison of surveys in front of Jersey City, '84, 779.

Plans.

By Maj. Gillespie, 1882, for the formation of a channel 300 feet wide and 21 feet deep at low water from the wharves of the Central Railroad of New Jersey to deep water in Kill von Kull, by rock removal and dredging. Estimated cost, \$7,134,990, '82, 721, 724; '85, 793.

By Maj. Gillespie, 1884, for obtaining a deep-water front along Jersey City and Hoboken by the advance of the pier-head line from Castle Point to Communipaw, '84, 777, 780. Extension of line further up stream suggested, '85, 793.

By Maj. Gillespie, 1885, for the improvement of Kill von Kull by the removal of the rocky ledges outside of the exterior wharf lines to a depth of 10 feet at low water. Estimated cost, \$1,090,000, '85, 795.

Surveys.

From Ellis Island to Constable Hook, ordered by act of March 3, 1881. Made under direction of Maj. Gillespie, '82, 719.

Of North River in front of New Jersey, ordered by act of August 2, 1882. Made under direction of Maj. Gillespie, '84, 774.

From Weehawken to Bergen Point, ordered by act of July 5, 1884. Made under the direction of Maj. Gillespie, 1884, '85, 790.

MAPS.

North River from Ellis Island to Fort Washington Point, '85, 792.

Upper New York Bay from Ellis Island to Bergen Point, '85, 792.

HUDSON, WIS.—EXAMINATION FOR HARBOR AT.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 229.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1886. Report, '87, 1723.

ASSISTANT.

F. T. Hampton. Report, '87, 1723.

Physical Characteristics.

Description, '87, 1723.

Plans.

Maj. Allen, in 1886, reports that no improvement is needed for the harbor at Hudson, '87, 1724.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Allen, '87, 1723.

HULL, MASS.—SURVEY OF HEADLAND AT.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 78.

ENGINEERS IN CHARGE.

Col. G. Thom. Report, '84, 552.

Maj. C. W. Raymond. Report, '84, 553.

ASSISTANT.

H. F. Bothfield. Report, '84, 554.

HULL, MASS.—Continued.**Plans.**

By Maj. Raymond, for the protection of the headland in the town of Hull, at the entrance to Boston Harbor, by the construction of a sea-wall, at an estimated cost of \$181,000, '84, 553, 557. Not recommended at present, '84, 553.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Maj. Raymond, '84, 522.

HULLS CREEK, VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1004.

Physical Characteristics.

Creek described, '84, 1004.

Plans.

In 1883 S. T. Abert considered that the improvement of Hulls Creek was not a public necessity, '84, 1004.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of S. T. Abert, '84, 1004.

HUMBOLDT HARBOR BAY, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 246.)

Appropriations.

1881.....	\$40,000, '81, 2481.
1882.....	40,000, '82, 2540.
1884.....	62,500, '84, 2200.
1886.....	*75,000, '86, 1921.

Total 217,500

1888..... 125,000, act of August, 11, 1888.

Commerce.

Anticipated benefit of improvement, '83, 1985.

Contracts.

1881. W. B. English, for dredging, at 34 cents per cubic yard, '81, 2481.

1882. J. Hackett, for dredging, at 25 cents per cubic yard, '83, 1944.

1884. W. B. English, for dredging, at 48 cents per cubic yard, '84, 2200.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 236; '81, 323; '82, 317; '83, 330; '84, 333; '85, 361; '86, 353; '87, 323.

BOARD OF ENGINEERS.

Convened at San Francisco, Cal., October 13, 1882, to report upon improvement of Humboldt Bay, '83, 1992.

(Col. Stewart, Lieut. Cola. Mendell, Craighill, and Comstock, and Capt. Powell.)

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Mendell, 1880-'85. Reports, '81, 2480, 2481; '82, 2539; '83, 1983, 1986; '84, 2199.

Capt. A. H. Payson, 1885-'— Reports, '85, 2351; '86, 1919; '87, 2447.

ASSISTANT.

A. Boeschke. Reports, '82, 2540; '83, 1984; '84, 2200.

Operations.

1881-'83. 95,744 cubic yards material dredged from Eureka and Arcata channels; protection from erosion of north spit by brush jetties, '82, 2539, 2541.

1882-'83. 75,904 cubic yards material dredged from Arcata, Hookton, and Eureka channels, '83, 1984.

1983-'84. 26,080 cubic yards material dredged from Eureka Channel, '84, 2200.

1884-'87. No operations, '86, 1919; '87, 2447.

* See Proviso of act of 1886, '87, 2447.

HUMBOLDT HARBOR BAY, CAL.—Continued.**Physical Characteristics.**

Description of bay, '81, 2482; '83, 1987.

Projects.

By Lieut. Col. Mendell, 1881, for securing, by dredging, a channel 13 feet deep and 200 feet wide to the upper end of Eureka Wharves, with channel 100 feet wide and 10 feet deep, to Arcata and Hookton. Estimated cost, \$135,220.05, '81, 2480, 2483.

In 1882, after the appropriation of \$80,000, Lieut. Col. Mendell proposed to obtain an increased depth of channel across the outer bar by a training-wall about 6,000 feet long, from the south spit, running in a northerly direction. Estimated cost, \$800,000, '83, 1991. Approved by the Board of Engineers of 1882, '83, 1992; '87, 2447.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Mendell, '81, 2481.

HUMPTULEPS RIVER, WASH.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 342.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '84, 2294.

Physical Characteristics.

River described, '84, 2295.

Plans.

In 1883 Capt. Powell did not consider the river worthy of improvement, '84, 2295.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Powell, '84, 2294.

HUNTER'S CREEK, VA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 114.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1886. Report, '87, 962.

Surveys.

Examination ordered by act of August 5, 1886, but Mr. Abert reports, after examination of the charts and personal inquiry, that he is unable to discover any such creek, '87, 962.

HUNTING CREEK, VA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 151.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '84, 961.

ASSISTANT.

J. L. Seager. Report, '84, 961.

Plans.

In 1882 Capt. Turtle did not consider the work a public necessity, '84, 961.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Capt. Turtle, '84, 961.

HUNTINGTON HARBOR, N. Y.—SURVEY OF.

(Continued from Vol. I, p. 246.)

Appropriations.

1872-'79 \$22,500

Commerce.

Justification of Improvement, '85, 706.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 96.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland. Report, '85, 703, 704.

Operations.

History of previous operations, '85, 703.

Plans.

By Col. McFarland, 1885, for the formation of a dredged channel 100 feet wide and 8 feet deep at low water on the bar, the widening of the channel near the wharves, and the protection of the channel by a pile revetment 1,400 feet long. Estimated cost, \$32,000, '85, 705.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Col. McFarland, '85, 704.

HUBON HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 247.)

Appropriations.

1826-'79	\$98,273.71
1880	3,000.00, '80, 2122.
1881	3,000.00, '81, 2303.
1882	2,500.00, '82, 2394.
1884	7,500.00, '84, 2093.
1886	3,000.00, '86, 1859.

Total 117,273.71

1888..... 6,000.00, act of August 11, 1888.

Contracts.

1880. J. Stang, for pile protection construction, '81, 2304.

1882. J. Stang, for removal and reconstruction of old superstructure, '83, 1900.

1884. L. P. & J. A. Smith, for pier repairs and dredging, '85, 2221.

1886. Stang & Gillmore, for dredging, at 25 cents per cubic yard, '87, 2307. L. P. & A. J. Smith, for repair to piers, '87, 2309.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 225; '81, 307; '82, 302; '83, 310; '84, 313; '85, 337; '86, 332; '87, 298.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2117; '81, 2302; '82, 2393.

Maj. L. C. Overman, 1883-'—. Reports, '83, 1898; '84, 2092; '85, 2219; '86, 1858; '87, 2307.

Operations.

History of work, '80, 2117.

1879-'80. Repairs to piers, '80, 2121.

1880-'81. 219 linear feet pile protection completed; repairs to piers, '81, 2302, 2303.

1881-'82. 300 linear feet east pier superstructure completed; pier repairs, '82, 2393.

1882-'83. 250 linear feet old work removed and rebuilt; 182 linear feet superstructure removed and rebuilt; repairs to piers by hired labor, '83, 1899.

1883-'84. No operations, '84, 2092.

1884-'85. 501 cubic yards material dredged, 185 linear feet of west pier rebuilt, and 576 linear feet repaired; 48 linear feet pile protection built and 72 linear feet repaired; repairs to piers, '85, 2220.

1885-'86. No operations, '86, 1858.

1886-'87. 4,147 cubic yards material dredged from bar; repair of piers in progress, '87, 2307.

HURON HARBOR, OHIO—Continued.**Projects.**

The project adopted in 1826 and modified in 1871 proposed the extension of two parallel piers 140 feet apart, the object being to afford a channel of entrance not less than 14 feet deep, '80, 2127; '85, 332.

Between 1826 and 1880 \$101,273.71 had been appropriated, '80, 2121. In 1879 Maj. Wilson proposed rebuilding superstructure to both piers and reconstruction of short breakwater at shore end of west pier. Estimated cost, \$25,000, '79, 1686; '80, 2121. Increased in 1885 by \$6,500, '85, 2220; '87, 2303.

Surveys.

Of harbor, 1879, '80, 2120; 1882, '82, 2393.

HURON (LAKE), HARBOR OF REFUGE ON.

(See SAND BEACH, LAKE HURON.)

HYANNIS HARBOR BREAKWATER, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 250.)

Appropriations.

1827-'79	\$118,431.82
1881	5,000.00, '81, 540.
1886	10,000.00, '86, 596.
1888	10,000.00, act of August 11, 1888.

Contracts.

1879. J. H. White, for granite riprap, at \$1.43 per ton, '80, 366.

1881. C. E. Davis, for riprap granite, at \$1.69 per ton, '81, 539.

1886. Frank Pidgeon Dredging Company, for dredging, at 14 $\frac{1}{2}$ cents per cubic yard, '87, 533.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72; '81, 77; '82, 77; '83, 72; '84, 79; '85, 68; '86, 68; '87, 31.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1873-'83. Reports, '80, 365; '81, 539; '82, 548.

Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 467; '84, 591; '85, 560, 619; '86, 585.

Maj. W. R. Livermore, 1887-'—. Report, '87, 532.

Operations.

History of work, '80, 366.

1879-'80. 1,211 tons of stone deposited at outside base of breakwater, '80, 366.

1880-'81. No operations, '81, 539.

1881-'82. 2,550 tons stone placed in interior and exterior of breakwater slopes, '82, 548.

1882-'86. No operations, '83, 467; '84, 591; '85, 560; '86, 586.

1886-'87. Dredging in harbor resumed; 2,441 cubic yards removed, '87, 532.

Projects.

The original project was for a breakwater of riprap stone 1,170 feet in length, covering an anchorage area of about 175 acres and having an entrance depth of 15 feet. This was commenced in 1827 and completed in 1838, at a cost of \$70,931, '80, 366; '86, 586, 619.

By Maj. Warren, 1873, for increasing width of base of breakwater and otherwise strengthening it. Estimated cost, \$25,000, '73, 86, 948, 949.

By Lieut. Col. Elliot, 1883, for increasing depth of anchorage area to 15 $\frac{1}{2}$ feet at mean low water. Estimated cost, \$45,743.20, '85, 621; '86, 586; '87, 532.

Surveys.

Of harbor, 1884, '85, 560, 619.

MAPS.

'84, 592; '85, 560.

ICE-BREAKERS, OHIO RIVER, AT PARKERSBURGH—EXAMINATION FOR.

(See OHIO RIVER AT PARKERSBURGH.)

ICE-BREAKER, OHIO RIVER, AT ROCHESTER AND FREEDOM, PA. (See OHIO RIVER AT ROCHESTER AND FREEDOM, PA.)

ICE-HARBOR AT BELLAIRE, OHIO. (See BELLAIRE, OHIO, ICE-HARBOR AT.)

ICE-HARBOR AT BELL RIVER, MICH. (See BELL RIVER, MICH., ICE-HARBOR AT.)

ICE-HARBOR AT CHESTER, PA. (See CHESTER, PA., ICE-HARBOR AT.)

ICE-HARBOR AT CINCINNATI, OHIO. (See CINCINNATI, OHIO, ICE-HARBOR AT.)

(Continued from Vol. I, p. 141.)

ICE-HARBOR AT COCK PIT, VA. (See COCKPIT POINT, VA., ICE-HARBOR AT.)

ICE-HARBOR HEAD OF DELAWARE BAY—SURVEY FOR.
(See DELAWARE BAY, ICE-HARBOR AT HEAD OF, SURVEY FOR.)

(Continued from Vol. I, p. 459.)

ICE-HARBOR AT DUBUQUE, IOWA. (See DUBUQUE HARBOR, IOWA, ICE-HARBOR AT.)

ICE-HARBOR AT MOUTH OF LITTLE KANAWHA RIVER, W. VA. (See LITTLE KANAWHA RIVER, W. VA., ICE-HARBOR AT.)

ICE-HARBOR AT MARCUS HOOK, PA. (See MARCUS HOOK ICE-HARBOR.)

ICE-HARBOR AT MIDDLEPORT, OHIO. (See MIDDLEPORT, OHIO, ICE-HARBOR AT.)

ICE-HARBOR AT MUSKINGUM RIVER. (See MUSKINGUM RIVER,
CONSTRUCTION OF ICE-HARBOR AT.)

ICE-HARBOR AT NEW CASTLE, DEL. (See NEW CASTLE, DEL.,
ICE-HARBOR AT.)

ICE-HARBOR FOR OHIO RIVER AT MUSKINGUM RIVER.
(See MUSKINGUM RIVER, OHIO.)

ICE-HARBOR AT POINT PLEASANT, W. VA. (See POINT PLEASANT,
W. VA., ICE-HARBOR AT.)

ICE-HARBOR AT REEDY ISLAND, DELAWARE' RIVER.
(See DELAWARE BAY, ICE-HARBOR AT HEAD OF.)

ICE-HARBOR AT SAINT LOUIS, MO. (See SAINT LOUIS, MO., ICE-
HARBOR AT.)

ILLINOIS AND DES PLAINES RIVERS, ILL.—SURVEY OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 291.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard. Report, '84, 1957, 1958.

ASSISTANT.

G. Y. Wisner. Report, '84, 1960.

Physical Characteristics.

Route described, '84, 1958, 1960.

Plans.

By Maj. Benyaard, 1884, for a slack-water navigation accomplished by locks and dams at an estimated cost of from \$1,975,446 to \$3,433,562, '84, 1959, 1964.

Surveys.

Ordered between La Salle and Joliet by act of August 2, 1882. Made under the direction of Maj. Benyaard, '84, 1958.

ILLINOIS AND MICHIGAN CANAL—ACQUISITION AND ENLARGEMENT OF.

Commerce.

Relation of the canal to commerce, '87, 2130-2137, 2145.

Statement of canal traffic, '87, 2148.

Rates of toll, '87, 2156.

Engineers.

CHIEF OF ENGINEERS.

Report, '83, 289; '84, 291; '85, 314; '86, 309; '87, 275, 2127.

BOARD OF ENGINEERS.

Of 1886 to examine and report upon the Illinois and Michigan Canal and its acquisition. Report, '87, 2128-2160. (Lieut. Cols. Comstock and Poe and Maj. Post.)

ILLINOIS AND MICHIGAN CANAL—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. W. H. H. Benyard. Reports, '83, 1761; '84, 1950; '85, 2056.

Maj. T. H. Handbury. Report, '86, 1716.

Legislation.

Acts relative to Illinois and Michigan Canal, '87, 2161.

Plans.

By Maj. Benyard, 1882, for the enlargement of the existing Illinois and Michigan Canal between Chicago and La Salle to a width of 80 feet at water-line and depth of 7 feet; locks 170 feet long and 30 feet wide. Estimated cost, \$2,298,919, '83, 1762, 1774, 1779, 1788; '86, 1713.

History and description of canal '87, 2128, 2141.

Original cost of canal, \$9,513,021, '87, 2147, 2167.

Conclusions of Board of Engineers of 1886 in relation to acquisition and enlargement of canal, '87, 2160.

Surveys.

Ordered by act of August 2, 1882, '83, 290. Made under direction of Maj. Benyard, 1883, '83, 1754.

ILLINOIS RIVER—IMPROVEMENT OF.

(Continued from Vol. I, p. 251.)

Appropriations.

1852-'79	\$639, 150
1880.....	110, 000, '80, 1994.
1881.....	250, 000, '81, 2181.
1882.....	175, 000, '82, 2246.
18-'4.....	100, 000, '84, 1948.
1886.....	112, 500, '86, 1706.
Total.....	1, 386, 650
1888.....	200, 000, act of August 11, 1888.

Commerce.

Importance of the improvement, '87, 2122.

Contracts.

1884. Sanger & Moody, stone, '84, 1950.

1886. Sanger & Moody, for lock stone, '87, 2124.

1887. Williams, White & Co., for lock-gate iron, '87, 2124.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 211, 212; '81, 286; '82, 281; '83, 289; '84, 290; '85, 313; '86, 308; '87, 274.

ENGINEERS IN CHARGE.

Maj. G. J. Lydecker, 1877-'82. Reports, '80, 1990, 1995; '81, 2174.

Maj. W. H. H. Benyard, 1882-'86. Reports, '82, 2245; '83, 1751; '84, 1948; '85, 2052; '86, 1705.

Maj. T. H. Handbury, 1886-'— . Report, '87, 2119.

Operations.

1879-'80. 110,237 cubic yards material dredged at Pearl Shoals, Fisher's Island, Atwell's and Silver Creek bars; 5,858 linear feet brush and stone dams built at above localities; 84 snags removed, '80, 1991, 1992.

1880-'81. 89,501 cubic yards material dredged at Atwell's and Hurricane Island bars; work on Kampsville Lock commenced, '81, 2174.

1881-'82. No operations, '82, 2245.

1882-'83. Coffor-dam and lock foundation constructed and lock-pit excavation commenced at La Grange; lock-pit and coffer-dam construction at Kampsville continued, '83, 1751, 1752.

1883-'84. Foundation of La Grange Lock completed and lock-walls commenced; foundation of Kampsville Lock completed, '84, 1948, 1949.

1884-'85. Work upon lock-walls at La Grange continued; east dam abutment completed, '85, 2052.

1885-'86. Lock-walls at La Grange completed, '86, 1705.

1886-'87. Progress upon work at La Grange and Kampsville locks, '87, 2120.

ILLINOIS RIVER—Continued.**Projects.**

Previous to 1880 efforts on the part of the General Government for the improvement of the river consisted in the construction of wing-dams and dikes, dredging through the worst bars, and the construction of the foundation of the Copperas Creek Lock, the State of Illinois undertaking the building of locks and dams and the United States the improvement of the river-bed, '71, 247; '73, 437; '74, i, 320; '75, i, 467; '86, 380.

The amount thus expended from 1868 to June 30, 1880, was \$550,450, '80, 1994, 1999; '86, 308.

The act of June 14, 1880, required that \$100,000 of the \$110,000 appropriated should be applied to the construction of locks and dams, '80, 276; '81, 2174.

The project of 1880 proposed the extension of slack-water navigation 100 miles by the construction of locks and dams at La Grange and Kampsville and the dredging of the river channel where needed between Copperas Creek Dam and mouth of river to obtain a low-water depth of 7 feet, '81, 2176, 2177. Estimated cost of the two locks and dams, \$680,000; for dredging, brush dams, and shore protection \$270,850, '81, 2177, 2181; '82, 2246.

In 1883 the estimate for locks and dams was increased to \$850,000, '83, 1753.

From 1880 to 1886, inclusive, \$747,500 was appropriated. In 1887 it was estimated that \$587,500 would be required to complete the project, '87, 2124.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Lydecker, '80, 1995.

MAPS.

'85, 2054; '87, 2124.

INDIANA CHUTE. (See OHIO RIVER, AT FALLS OF.)**INDIANOLA HARBOR, TEX. (See MATAGORDA BAY.)****INDIAN RIVER, DEL.—IMPROVEMENT OF.****Appropriations.**

1882 \$10,000, '83, 651.

Commerce.

Statistics, '83, 651.

Contracts.

1883. F. C. Somers, for dredging, at 34½ cents per cubic yard, '83, 651.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 127; '83, 127; '84, 135, 151; '85, 131; '86, 129; '87, 91.

ENGINEERS IN CHARGE.

Capt. W. Ludlow, 1881. Reports, '82, 824; '83, 135.

Maj. W. H. Heuer, 1884-'85. Report, '84, 840.

W. F. Smith, U. S. Agent, 1885-'— . Reports, '85, 881; '86, 864; '87, 835.

ASSISTANTS.

E. Ludlow. Report, '82, 830.

J. N. Odiorne. Reports, '83, 651; '84, 841.

Operations.

1882-'83. 2,476 cubic yards material dredged from channel, '83, 650.

1883-'84. 23,326 cubic yards material dredged, '84, 841.

1884-'87. No operations, '85, 882; '86, 864; '87, 835.

Physical Characteristics.

Tides in Indian River and Rehoboth Bays, '83, 832.

Rain-fall, '82, 833.

Projects.

By Capt. Ludlow, 1882, for improvement of river between its mouth and Millsborough, by excavation of channel through "Bulkhead" Shoal, 3,000 feet long, 80 feet wide, and 4 feet deep; thence to the inlet, 2,000 feet in length, 150 feet wide, and 5 feet in depth, the channel to be protected by a dike on its north side. Estimated cost, \$50,000, '82, 833. Increased in 1883 to \$60,000, '83, 650; '87, 835.

INDIAN RIVER, DEL.—Continued.**Surveys.**

Ordered by act of March 3, 1881. Made, 1882, under direction of Col. Macomb, '82, 829.

Examination of Isle of Wight and Upper Synepuxent bays, Md., and Indian River, Del., and intervening land, with a view to connecting their waters, ordered by act of August 2, 1882. Made, 1882, under direction of Lieut. Col. Craighill, and adjudged by him as unworthy of improvement, '84, 957.

INDIAN RIVER, FLA.—INCLUDING EXAMINATION AND SURVEYS OF CONNECTING WATERWAYS.

(Continued from Vol. I, p. 255.)

Appropriations.

1844-'52 \$6,500

Commerce.

Commercial statistics, '82, 1242; '85, 1291.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 176; '84, 194; '85, 199; '87, 162.

ENGINEERS IN CHARGE.

Col. Q. A. Gillmore. Reports, '82, 1229; '84, 1144.

Capt. J. C. Post. Report, '84, 1143.

Capt. W. Rossell. Report, '85, 1287, 1288.

Capt. W. M. Black. Report, '87, 1261.

ASSISTANTS.

J. F. Le Baron. Report, '82, 1233.

A. W. Barber. Report, '85, 1293.

Operations.

History of previous operations towards the construction of a canal connecting Indian River with Mosquito Lagoon, '82, 1229, 1233; '84, 1148.

Plans.

By Col. Gillmore, 1881, for an enlargement of the section of the existing canal from Mosquito Lagoon to Indian River to a width of 60 feet and a depth of 4½ feet. Estimated cost, \$66,000, '82, 1231, 1232, 1238, 1241; '84, 1143.

Modified in 1884 and estimate increased to \$68,800, '84, 1146; '85, 1292.

By Capt. Rossell, 1884, for the improvement of the entrance to Mosquito Inlet, by the construction of two jetties at an estimated cost of from \$500,000 to \$750,000, '85, 1290.

In 1887 Capt. Black did not consider the improvement of the channel from Haulover on Indian River to Gilbert's Bar worthy of improvement, '87, 1261.

Physical Characteristics.

Description of locality, '82, 1234; '84, 1146; '85, 1288.

Surveys.

Between Indian River and Mosquito Lagoon ordered by act of July 14, 1880.

Made under direction of Col. Gillmore, '82, 1229.

Survey of same locality ordered by act of August 2, 1882. Made under direction of Col. Gillmore, '84, 1143, 1144.

For line of inland communication from St. John's River to Jupiter Inlet via Mosquito Lagoon, ordered by act of July 5, 1884. Made under the direction of Capt. Rossell, '85, 1291.

Of Mosquito Inlet ordered by act of July 5, 1884. Made under the direction of Capt. Rossell, '85, 1288.

Examination of channel from Haulover on Indian River to Gilbert's Bar ordered by act of August 5, 1886. Made under direction of Capt. Black, '87, 1261.

INSIDE PASSAGE BETWEEN FERNANDINA AND ST. JOHN'S RIVER, FLA. (See ST. JOHN'S RIVER AND FERNANDINA, FLA.)**INSIDE PASSAGE BETWEEN NEW BERNE AND BEAUFORT, N. C.** (See NEW BERNE AND BEAUFORT.)

IOWA RIVER, IOWA—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 244.

ENGINEER IN CHARGE.

Maj. A. Mackenzie. Report, '84, 1591.

Plans.

In 1882 Maj. Mackenzie considered that the improvement of the river would be easy at a large cost, but that the work was not a public necessity, '84, 1592.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Mackenzie, '84, 1591.

IPSWICH RIVER, MASS.—SURVEY AND EXAMINATION OF.

(Continued from Vol. I, p. 255.)

Appropriations.

1886..... \$2,500, '87, 497.

1888..... 2,500, act of August 11, 1888.

Contracts.

1886. T. Symonds, for dredging, at 31½ cents per cubic yard, '87, 497.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 79; '87, 24.

ENGINEERS IN CHARGE.

Col. G. Thom. Report, '84, 557, 560.

Maj. C. W. Raymond. Report, '84, 558.

Lieut. Col. G. L. Gillespie. Report, '87, 495.

ASSISTANT.

S. Haagenesen. Report, '84, 562.

Operations.

1886-'87. 4,665 cubic yards dredged from channel through the shoals, '87, 496.

Physical Characteristics.

Description of the river, '84, 560, 563.

Projects.

By Col. Thom, 1875, for the formation of a channel 60 feet wide and 4 feet deep at mean low water, from Barras Turns to the town wharves. Estimated cost, \$25,000, '76, i, 199-202; '84, 559, 561, 564; '87, 495.

Surveys.

Ordered by act of August 2, 1882. Made under the direction of Col. Thom, '84, 557.

MAPS.

'87, 496.

ISLE OF WIGHT BAY, UPPER SYNEPUENT BAY, AND INDIAN RIVER—EXAMINATION OF, WITH A VIEW TO CONNECT THEIR WATERS.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 151.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '84, 957.

Plans.

In 1882 Capt. Turtle did not consider the proposed line of water communication worthy of improvement nor the work a public necessity, '84, 957.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Turtle, '84, 957.

ISLIAS CREEK (San Francisco Bay), CAL.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 2340.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '85, 2340.

ISLIAS CREEK (San Francisco Bay), CAL.—Continued.**Plans.**

In 1884, in view of the bridge obstructing the navigation of the creek, Col. Mendell did not consider the stream worthy of improvement, '85, 2341.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Col. Mendell, '85, 2340.

JOY LANDING, ILL.—EXAMINATION OF.

(See MISSISSIPPI RIVER AT RUSH BEND AND JOY LANDING.)

JAMAICA BAY AND ROCKAWAY INLET—EXAMINATION FOR CHANNEL BETWEEN.**Commerce.**

Value of oyster trade, '87, 755.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 67.

ENGINEER IN CHARGE.

Lient. Col. W. McFarland, 1886. Report, '87, 754.

ASSISTANT.

M. Kingsley. Report, '87, 756.

Physical Characteristics.

Description, '87, 754.

Plans.

Lieut. Col. McFarland, 1886, considers cost of improvement far beyond the requirements of existing commerce, '87, 758.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. McFarland, '87, 754.

JAMES RIVER, DAK.—EXAMINATION OF.**Commerce.**

Statistics, '87, 1604.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 217.

ENGINEER IN CHARGE.

Capt. C. B. Sears. Report, '87, 1603.

Physical Characteristics.

Description of river, '87, 1603.

Plans.

In 1886 Capt. Sears reports that the river can not be made navigable by the ordinary means of improving the natural channel for the reasons that there is not a sufficiency of water and that the channel is too tortuous, '87, 1606.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Capt. Sears, '87, 1603.

JAMES RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 256.)

Appropriations.

1836-79	\$530,500
1880	75,000, '80, 648.
1881	60,000, '81, 892.
1882	75,000, '82, 860.
1884	75,000, '84, 905.
1886	112,500, '86, 890.

Total	928,000
1888	225,000, act of August 11, 1888.

JAMES RIVER, VA.—Continued.**Appropriations—Continued.**

1852. \$45,000 for improvement of James and Appomattox rivers below Richmond and Petersburg, act of August 30, 1852.

List of appropriations previous to 1880, '86, 888.

Contracts.

1879. J. Caler, for dredging, at 16 and 14 $\frac{1}{2}$ cents per cubic yard, '80, 649.

1880. G. H. Ferris, for dredging, at 23 cents per cubic yard, '81, 892. J. Caler, for dredging, at 15 and 17 cents per cubic yard, '81, 892.

1884. D. Constantine, for dredging, at 11 cents per cubic yard, '85, 945.

1886. J. Caler & Son, for dredging, at 12 $\frac{1}{2}$ cents per cubic yard, '87, 868.

1887. J. F. Gaynor, for construction of jetties and dikes, '87, 870. G. E. Ward, for dredging, '87, 870. J. L. Wilson, for rock removal, '87, 870.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 105; '81, 141, 150; '82, 137, 144; '83, 141; '84, 146; '85, 142; '86, 137; '87, 100.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1870-'84. Reports, '80, 647; '81, 891; '82, 860; '83, 6-3; '84, 904.

Lieut. Col. P. C. Hains, 1884-'—. Reports, '85, 944; '86, 887; '87, 867.

ASSISTANTS.

H. D. Whitcomb. Reports, '80, 648, 649; '81, 892; '82, 887.

Capt. T. Turtle. Reports, '82, 861, 872; '83, 684.

C. P. E. Burgwyn. Reports, '82, 878; '84, 905; '85, 948; '87, 870.

Operations.

History of work previous to 1880, '80, 651.

1879-'80. 175,593 cubic yards of material removed and 4,621 linear feet wing-dams built by United States; 48,999 cubic yards material removed and 396 linear feet wing-dam built by city of Richmond, '80, 647.

1880-'81. Rock removal and 190,424 cubic yards dredged by United States, and 57,847 cubic yards by city of Richmond; 4,463 linear feet wing-dams built by United States, '81, 894.

1881-'82. 126,826 cubic yards material removed, 2,005 linear feet wing-dams and 350 linear feet fascine work constructed, '82, 863.

1882-'83. 44,340 cubic yards sand and 227 cubic yards rock removed by city of Richmond, '83, 685.

1883-'84. Rock removal continued, '84, 905.

1884-'85. 307 linear feet of jetty and 2,609 linear feet brush dike built, 1,100 cubic yards solid rock blasted and dredged, '85, 949, 950. 46,750 cubic yards material dredged, '85, 951. 153,191 cubic yards material dredged, '85, 945; 16,400 cubic yards material removed by city of Richmond and railroad companies, '85, 954.

1885-'86. 122,320 cubic yards sand and 1,240 cubic yards rock and gravel dredged from channel, '86, 889.

1886-'87. 20,670 cubic yards sand and gravel and 97 boulders removed from King-land Reach; 862 cubic yards dredged at Randolph Flats and 981 linear feet of jetty built; 635 cubic yards rock removed at Goode's Rocks, '87, 870, 872.

Physical Characteristics.

Tides at Richmond, '80, 650; '81, 896; '82, 866, 879.

Cross-sectional areas of river bottom near Richmond, '82, 866. List of freshets and height of rise of each since 1847, '82, 868. Float observations, 1882, '82, 868.

Report of survey showing condition of river and proposed improvements in 1837, '82, 888. Cross-sections, '85, 955.

Comparative cross-sections of river, '87, 873.

Private and Corporate Work.

Assistance given by city of Richmond by money appropriated, work done, placing machinery at disposal of Government, '80, 647; '81, 891, 894; '83, 685; '85, 954.

Total expenditures by city of Richmond, \$444,696.45, '86, 138; '87, 867.

Projects.

The original project of 1870, together with its modifications to 1882, proposed to secure between Richmond and the sea a channel 180 feet wide and 18 feet deep at full tide, or about 15 feet deep at mean low water. It was to be secured by the removal of rock and boulders, dredging on bars, and deposition of material behind rectifying dikes; excavation through Dutch Gap Cut-off and cut-offs near Jones Neck and Bermuda Hundred, '71, 604; '72, 631; '76, i, 298; '79, 516, 520; '86, 134. The aggregate of the appropriations from 1870 to 1882, inclusive, was \$740,000.

JAMES RIVER, VA.—Continued.**Projects**—Continued.

In 1882 Col. Craighill proposed to increase the previous widths and depths of channels so as to secure 25 feet at full tide, or 22 feet at half tide, between Richmond and the sea. The width of channels to be as follows: From mouth to City Point 400 feet, from thence to Drewry's Bluff 300 feet, and from thence to city of Richmond 200 feet. Estimated cost, \$4,500,000, '82, 871, 876; '85, 947; '86, 138; '87, 867.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Lieut. Col. Craig-hill, '82, 870, 878.

Comparison made in 1884 and 1887, '84, 906; '87, 873.

JEFFERSONVILLE, IND. (See OHIO RIVER.)**JEKYL CREEK, GA.**—EXAMINATION OF.

[\$5,000 appropriated by act of August 11, 1888.]

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 1162; '87, 154.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1880. Report, '81, 1162.

Physical Characteristics.

Description, '81, 1162.

Plans.

By Lieut. Col. Gillmore, 1880, for improvement of the creek from its mouth to the deep waters of Brunswick River by training-wall and closure-dam construction, and dredging. Estimated cost, \$25,323, '81, 1164.

Surveys.

Examination ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Gillmore, '81, 1162.

Examination ordered by act of August 5, 1886, '87, 154.

JONESPORT, ME.—IMPROVEMENT OF MOOSABEC BAR AT.

(See MOOSABEC RIVER AT JONESPORT, ME.)

JUPITER INLET, FLA. (See INDIAN AND ST. JOHN'S RIVERS, FLA.)**KANAWHA RIVER, GREAT, W. VA.**—IMPROVEMENT OF.

(Continued from Vol. I, p. 262.)

Appropriations.

1873-'79	\$992,000
1880	200,000, '80, 683.
1881	200,000, '81, 911.
1882	200,000, '82, 920.
1884	200,000, '84, 928.
1886	187,500, '86, 1590.

Total	1,979,500
1888	350,000, act of August 11, 1888.

KANAWHA RIVER, GREAT, W. VA.—Continued.**Contracts.**

1880. W. D. Lewis, for timber, '80, 683. H. L. Fearing, proof chair, at 7.94 cents per pound, '80, 684. Harris & Black, for materials and labor for Lock No. 6, '81, 916.
1881. J. E. Thayer, for tug-boat hull, '81, 916. J. Gilliland, for construction of houses and Locks 3 and 5, '82, 924. J. Morgan, for construction of house at Lock 4, '82, 924.
1882. J. E. Thayer, for side-dumping scow, '82, 925.
1883. F. Hefright, for part construction of Lock No. 2, '83, 708. D. Egan, for lock-house construction, '83, 709. D. Egan, for lock-house construction, '84, 930.
1884. Harold, McDonald & Co., for foundation, pier, and abutment construction, '85, 1848. O. A. & W. T. Thayer, for iron, '85, 1848.
1885. C. H. Strong & Son, for lock construction, '85, 1849. Snead & Co. Iron Works, for iron, '85, 1850. Martz, Kulp, McWilliams & Co., for gate and wickets, '86, 1592.
1886. Ainalie, Cochran & Co., for lock-gates, '86, 1592. West Lebanon Rolling Mill Company, for chain, '86, 1593. T. W. Farley, for telephone poles, at 75 cents, '87, 914. H. Crawford, for lock-house construction, '87, 1914. Layten & F. C. Williams, for crane-boat construction, '87, 1915. J. E. Thayer, for fuel boat construction, '87, 1915.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 108, 684; '81, 145; '82, 142, 930; '83, 146; '84, 149; '85, 285; '86, 279; '87, 249.

BOARD OF ENGINEERS.

Convened at Detroit, Mich., June 21, 1882, by S. O. No. 24, to report upon work of improvement completed, in progress, and proposed, '82, 926.

(Lieut. Col. Comstock, Maja. Weitzel and Merrill, and Capt. Turtle.)

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1874— Reports, '80, 681, 685; '81, 911; '82, 919; '83, 706; '84, 928; '85, 1845; '86, 1589; '87, 1911.

ASSISTANTS.

Lieut. T. Turtle. Report, '80, 686.

Capt. E. H. Ruffner. Reports, '81, 911; '82, 920.

A. M. Scott. Reports, '83, 710; '84, 930; '85, 1850, 1855; '86, 1594; '87, 1915.

Legislation.

Act proposed by Col. Craighill to provide for the operation, maintenance, and repairs of the locks and dams, '80, 685. Rejected by Congress, '81, 147.

Proposition of West Virginia to abandon jurisdiction of river to United States refused by Secretary of War, '82, 919.

Operations.

1879-'80. Lock and Dam No. 3: Stone prepared; coffer-dam placed; excavation and masonry commenced for lock; 12,839 cubic yards masonry built. Lock and Dam No. 4: Lock ready for gates; 120 linear feet of retaining-crib built; pass, pier, and river-walls completed; coffer-dam nearly finished. Dredging Lock and Dam No. 5. Dredging of lock approaches; bulkheads built across ends of lock; masonry work completed, '80, 686, 687, 688.

1880-'81. Lock and Dam No. 3: Masonry work on river-wall completed; 2,200 yards paving on land and land-wall laid; cribs at foot of lock completed. Lock and Dam No. 4 completed and in working order. Lock and Dam No. 5 completed and in working order, '81, 911, 912, 913.

1881-'82. Lock and Dam No. 3: Land-wall bolted to foundation rock; 280 linear feet of foundation crib-work for dam constructed; 560 linear feet of foundation trench dredged; 10,000 cubic yards stone placed in dam. Locks and Dams 4 and 5 in operation. Lock and Dam No. 6: 3,441 cubic yards masonry placed, '82, 920, 921, 922, 923.

1882-'83. Lock No. 2 (for stationary dam): Work commenced under contract. Locks 3, 4, and 5 in operation, and Lock 6 nearly finished; dredging, '83, 710, 711, 712, 713.

1883-'84. Lock No. 2: 17,500 cubic yards material dredged; coffer-dam built; masonry bed rock prepared and lock-house built. Lock No. 6 completed and dam for same commenced, '84, 930, 931, 933.

1884-'85. Lock No. 2: Construction advanced by 9,922 cubic yards masonry placed and 9,180 cubic yards excavation. Dam No. 6: Masonry work and second section of coffer-dam completed, '85, 1850, 1851, 1853.

1885-'86. Lock No. 2 and Dam No. 6 nearly completed; dredging, '86, 1595, 1597.

1886-'87. Locks and Dams 2 and 6 completed and put in operation, '87, 1912.

KANAWHA RIVER, GREAT, W. VA.—Continued.**Projects.**

By Lieut. Col. Craighill, 1875, for improvement, as revised by Board of Engineers, from mouth of Great Falls, 97 miles, to secure a low-water depth of from 6 to 7 feet by a combination of permanent and movable dams. (See Index, Vol. I, pp. 263, 265.) Omission of Lock and Dam No. 1, '79, 550. Recommendation of Board of Engineers of 1882, '82, 828, 829.

In 1886 Locks and Dams Nos. 3, 4, and 5 were completed, and Lock and Dam No. 6, with No. 2 nearly completed, '86, 280.

Amount appropriated for permanent improvement, \$1,929,500; amount required to complete project, \$1,670,000, '86, 281.

Secretary of War.

Report, '80, 648.

Surveys.

For location of Dams 6 and 7, '80, 689.

For location of Lock and Dam No. 2, '81, 915.

MAPS.

'80, 682.

KANAWHA RIVER, GREAT, W. VA.—HARBOR OF REFUGE AT MOUTH OF.**Appropriations.**

1884..... *\$15,000, '85, 1827.

Contracts.

1884. Porter, Tucker & Mahan, for construction of two ice-piers, '85, 1827.

1885. J. J. Shipman, for the construction of one ice-pier, '86, 1550.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 284; '86, 275; '87, 241.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1884.—. Reports, '85, 1826; '86, 1550; '87, 1822.

Operations.

1884-'85. Partial construction of two ice-piers at mouth of river, '85, 1827.

1885-'86. Completion of three ice-piers, '86, 1550.

Projects.

By Lieut. Col. Merrill, for the formation of a harbor of refuge at the mouth of the Great Kanawha by the construction of three ice-piers at an estimated cost of \$15,000, '84, 1827; '86, 1550; '87, 1822.

KANAWHA RIVER, LITTLE, W. VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 266.)

Appropriations.

1876-79	\$43,300
1880.....	15,000, '80, 1833.
1881.....	40,000, '81, 1990.
1882.....	31,000, '82, 1958.
1886.....	16,875, '86, 1624.

Total 146,175

1888..... 25,000, act of August 11, 1888.

List of appropriations previous to 1880, '83, 1574.

Commerce.

Tolls collected by Little Kanawha Navigation Company for 1891, '81, 1990.

Contracts.

1882. T. B. Townsend, for dimension and rubble-stone, at \$4.50 and \$3.50 per cubic yard, '82, 1959.

1886. Portsmouth Foundry and Machine Works, for boilers and machinery for lock construction, '85, 1891. S. M. Hamilton & Co., for cement, at \$1.40 per barrel. A. J. Mitchell, for sawed lumber, '85, 1891. A. J. Mitchell, for timber, '85, 1891. Morris & Co., for coal, at 8½ cents per bushel, '85, 1891.

* Allotment from appropriation for the Kanawha and Ohio rivers, '86, 1826.

KANAWHA RIVER, LITTLE, W. VA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 197; '81, 265; '82, 250; '83, 267; '84, 266; '85, 291; '86, 285; '87, 242.

ENGINEERS IN CHARGE.

Maj. J. W. Cuyler, 1880-'83. Reports, '80, 1831; '81, 1968; '82, 1957.

Capt. J. C. Post, 1883-'87. Reports, '83, 1572; '84, 1754; '85, 1890; '86, 1623.

Lieut. Col. W. E. Merrill, 1887-'— . Report, '87, 1828.

ASSISTANTS.

W. E. Strong. Report, '80, 1833.

M. W. Venable. Report, '87, 1830.

Operations.

1879-'80. 27,378 trees and 11,925 snags cut and removed; 11,133 linear feet crib-dams and 3,712 linear feet brush dams built, '80, 1835.

1880-'82. No operations, '81, 1968; '82, 1957.

1882-'83. Stone for lock and dam received and prepared, '83, 1572.

1883-'84. Preparations of stone continued, '84, 1754.

1884-'85. Machinery placed and coffer-dam half finished, '85, 1890.

1885-'86. Cofferdam completed; foundation of mitre and river walls excavated and walls partially built upon concrete foundation, '86, 1623.

1886-'87. Construction of lock; river and head walls commenced, '87, 1829.

Projects.

The project of 1876 proposed the construction of a lock and dam near Burning Springs, so as to extend slack-water navigation, for a draught of 4 feet, a distance of 12 miles, and the improvement of the natural channel for an additional distance of 80 miles, by the removal of obstructions so as to obtain a channel 40 feet wide and at least 2 feet deep during four months of the year. Estimated cost of lock and dam, \$62,000, '73, i, 741. In 1878 the dimensions of the lock were increased and the cost estimated at \$84,200, '78, 813; '81, 1989; '82, 1958. In 1883 the estimate was increased to \$135,672.47, '83, 1573. Of the \$129,300 appropriated previous to 1883 \$43,300 was for the removal of obstructions, '83, 1574. Increased cost of work due to the small appropriations, '86, 1623.

Surveys.

Examination, 1884, of previous works of improvement upon the river, '84, 1754.

KANKAKEE RIVER, ILL. AND IND.—SURVEY OF.

(Continued from Vol. I, p. 267.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 199.

ENGINEER IN CHARGE.

Maj. J. A. Smith. Report, '80, 1844.

Plans.

By Maj. Smith, 1890, for improvement from its mouth to Momence, by slack-water navigation, to be secured by three masonry locks with a lift of 12 feet, 63,000 linear feet canal, construction and repair of dams, and removal of reefs and similar obstructions. Estimated cost, \$550,000, '80, 1844, 1846.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Smith, '80, 1844.

KANKAKEE RIVER, IND.—EXAMINATION OF.**Commerce.**

Small amount of, '85, 1646.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 269; '85, 257.

ENGINEERS IN CHARGE.

Maj. J. A. Smith. Report, '84, 1766.

Capt. J. C. Post. Report, '85, 1645.

ASSISTANT.

A. L. Duvall. Report, '85, 1647.

KANKAKEE RIVER, IND.—Continued.**Physical Characteristics.**

Description of rock forming bed of river, '84, 1766.

Description of river, '84, 1867; '85, 1647.

Plans.

In 1882 Maj. Smith considered that the river could only be improved by a slack-water navigation, but that the work was not a public necessity, '84, 1767, 1768.

In 1884 Capt. Post did not consider the river worthy of improvement, '85, 1647.

Surveys.

Examination ordered by acts of August 2, 1882, and July 5, 1884, '84, 1766; '85, 1645.

KANSAS CITY, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**KENNEBEC RIVER, ME. (See BATH, ME.)****KENNEBUNK RIVER, ME.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 270.)

Appropriations.

1829-79	\$61, 175
1880	2, 000, '80, 339.
1881	2, 000, '81, 492.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 67; '81, 69; '82, 68; '83, 63; '84, 71; '85, 58; '86, 57; '87, 19.

ENGINEERS IN CHARGE.

Col. G. Thom, 1870-'83. Reports, '80, 337; '81, 491; '82, 499.

Col. C. E. Blunt, 1883-'86. Reports, '83, 422; '84, 468; '85, 470.

Maj. J. A. Smith, 1886-'—. Reports, '86, 543; '87, 461.

Operations.

History of work, '82, 499.

1880-'81. Ledges below Ward's Wharf and at mouth of Gooch Creek removed to 4 feet depth; channel straightened and widened by dredging below Lord's and Ward's wharves and at upper part of Mitchell's Point; repairs to Government wharf, '81, 492.

1881-'82. Repairs to stone piers and Government wharf, '81, 500.

1892-'83. No operations, '83, 422.

1883-'84. Repairs to Government wharf, '84, 468.

1886-'87. No operations, '87, 461.

Projects.

By Col. Thom, 1878, for dredging, rock excavation, and repairs to piers and wharves. Estimated cost, \$6,000, '78, 203; '79, 260. Project completed in 1882, '82, 500; '87, 19.

KENOSHA HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 271.)

Appropriations.

1844-79	\$194, 307. 41
1880	5, 000. 00, '80, 1940.
1881	5, 000. 00, '81, 2129.
1882	6, 000. 00, '82, 2161.

KENOSHA HARBOR, WIS.—Continued.**Appropriations—Continued.**

1884.....	5,000.00, '84, 1870.
1886.....	5,060.00, '86, 1684.

Total	229,307.41
1888.....	7,500.00, act of August 11, 1888.

Contracts.

1879. Knapp & Gillen, for pier extension, '80, 1940.
 1881. Knapp & Gillen, for pier extension, '81, 2129.
 1882. Knapp & Gillen, for removal and reconstruction of superstructure, '83, 1709.
 1884. G. H. Sager, for reconstruction of superstructure, '85, 2022.
 1886. H. B. Herr & Co., for superstructure reconstruction, '87, 2072.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 208; '81, 282; '82, 277; '83, 285; '84, 286; '85, 309; '86, 303; '87, 368.

ENGINEERS IN CHARGE.

Lient. Col. D. C. Houston, 1870-'84. Reports, '80, 1938; '81, 2128; '82, 2161; '83, 1708.

Capt. W. L. Marshall, 1884-'—. Reports, '84, 1869; '85, 2021; '86, 1684; '87, 2072.

ASSISTANT.

W. H. Hearing. Reports, '80, 1939; '81, 2128; '82, 2162; '83, 1709; '84, 1870; '85, 2022; '87, 2073.

Operations.

1879-'80. Crib 50 by 24 by 16½ feet sunk upon stone foundation in extension of north pier; 100 linear feet superstructure built; 14-foot channel dredged between piers by city authorities, '80, 1939.

1880-'81. No operations, '81, 2128.

1881-'82. Crib 50 by 24 by 16½ feet sunk in extension of north pier; 26 cords rip-rap placed along north face of crib, '82, 2162.

1882-'83. Superstructure upon two cribs built up and latter decked over; north wall timbers built up 7½ feet, '83, 1709.

1883-'84. Double row of sheet-piling 170 feet in length, driven along south face of south pier; 20 cords of stone placed in cribs and around end of pier; repairs to south pier, '84, 1870.

1884-'85. 355 linear feet superstructure and outer section of south pier removed and rebuilt, '85, 2022.

1885-'86. No operations, '86, 1684.

1886-'87. 408 linear feet of south pier superstructure cut down and rebuilt under contract, '87, 2072.

Projects.

From 1844 to 1879, inclusive, \$194,307.41 had been appropriated for pier extension, dredging, and repairs, '80, 208.

By Maj. Houston, 1879, for completion of Maj. Wheeler's project of 1866 for securing a channel of 12 feet depth and navigable width by pier extension and dredging, \$67,000, '79, 156; '80, 1938.

Surveys.**MAPS.**

'84, 1870.

KENT ISLAND NARROWS, MD. (See CHESTER RIVER, MD.)**KENTUCKY RIVER, KY.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 273.)

Appropriations.

1879.....	\$100,000
1880.....	100,000, '80, 1827.
1881.....	125,000, '81, 1976.
1882.....	225,000, '82, 1949.
1884.....	250,000, '84, 1725.
1886.....	187,500, '86, 1606.

Total 987,500

KENTUCKY RIVER, KY.—Continued.**Appropriations—Continued.**

1888..... 180,000, act of August 11, 1888.
List of appropriations previous to 1860, '83, 1563.

Contracts.

1832. Stratham & Price, for iron work, '82, 1949.
1884. M. Williams, for materials and labor for abutment construction, '85, 1873.
H. C. Jones, for timber for guard-crib repair, '85, 1873. Kirk & Abraham, for materials, '85, 1874. T. J. Hardin, for timber, '85, 1874. W. L. Pence, for timber, '85, 1874. I. V. Hoag, jr, for materials and labor, '85, 1875.
1885. Lomas Forge and Bridge Works, for cast and wrought iron work, '85, 1875.
J. J. Cox, for material and labor, '85, 1876. Lomas Forge and Bridge Works, materials and labor, '86, 1606.
1886. T. J. Hardin & Co., timber and piles, '86, 1607. T. J. Congleton & Brother, lumber, '86, 1607. T. Morris, for cast and wrought iron, '86, 1608. T. H. Caruthers, for wrought-iron spikes, '86, 1608. Scully & Peter, for riprap stone, '86, 1609. E. M. Fryse & Brother, for coal, at 6 cents per bushel, '86, 1609. G. W. Gourley, for coal, at 6 cents per bushel, '86, 1609.
1887. O'Brien & Co., for lock stone, '87, 1875.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 195; '81, 263; '82, 257; '83, 265; '84, 264, 1728; '85, 288; '86, 282; '87, 247.

BOARD OF ENGINEERS.

Convened at Cincinnati, Ohio, November 19, 1883, by S. O. No. 146, C. of E., to report upon the erection of a lock and movable dam at junction of the "Three Forks of Kentucky River." Report, '84, 1729, 1731. (Lieut. Cola. Craighill and Merrill and Capt. Post.)

Convened at Frankfort, Ky., March 9, 1887, by S. O. No. 23, to examine and report upon Maj. Post's project for Lock and Dam No. 6. Report, '87, 1879. (Lieut. Cola. Poe and Merrill and Maj. Stickney.)

Convened at Washington, D. C., May 30, 1887, by S. O. No. 146, to report upon the subject of modifications required for remedying the difficulties experienced in passing boats through the chutes of the movable dam at Beattyville. Report, '87, 1882. (Col. Craighill, Lieut. Col. Merrill, and Maj. Post.)

ENGINEERS IN CHARGE.

Maj. W. E. Merrill, 1879-'80. Report, '79, 195.
Maj. J. W. Cuyler, 1880-'83. Reports, '80, 1825; '81, 1971; '82, 1945.
Capt. J. C. Post, 1883-'87. Reports, '83, 1559; '84, 1723, 1728, 1731; '85, 1869, 1878; '86, 1603, 1610.
Maj. A. Stickney, 1887-'—. Report, '87, 1872, 1885.

ASSISTANTS.

D. L. Sublett. Reports, '84, 1726; '85, 1876; '86, 1613.
R. S. Bennett. Report, '87, 1875, 1889.

Operations.

1879-'80. Removal of State Dams No. 1, 2, and 3 nearly completed, '80, 1826.

1880-'81. New dam half completed upon site of Dam No. 1; 130-foot breach in Dam No. 2 closed by crib-work; new dam nearly completed on site of Dam No. 3; new upper gates built for Dam No. 4; repairs to lock-houses; construction of quarter-boats and derricks, '81, 1793, 1794.

1881-'82. Breach through bank above abutment at Dam No. 1 repaired, '82, 1947.

1882-'83. Old gates removed and grounds inclosed at Lock No. 5; guard-cribs built and filled with stone; extensive repairs to old dam at Lock No. 4; guard-cribs and lower end of stone abutment raised, and lower river crib lengthened at Lock No. 3; dam at Lock No. 2 completed; work in breach at Lock and Dam No. 1 capped by 196 linear feet of crib-work filled with stone; 675 linear feet guard-cribs built above and below lock; gap below dam permanently closed by piling, brush and crib-work, '83, 1560.

1883-'84. Dam No. 1 resheeted and sheet-piling placed in rear of same; leak in Dam No. 2 repaired; 528 linear feet new apron constructed at Dam No. 4, '84, 1724.

1884-'85. Outlet to breach at Lock and Dam No. 1 raised and 5,000 cubic yards backing placed behind the dam; bar below lock removed; stone crib built; lock-chamber and up-stream approach cleaned at Dam No. 5; mitre-sills rebuilt; walls and coping repaired; guard-cribs reconstructed; gates framed and new abutment built; 169 snags removed and 1,200 trees cut and girdled, '85, 1869, 1871. Operation and repair of locks and dams, '85, 1876.

KENTUCKY RIVER, KY.—Continued.**Operations—Continued.**

1885-'86. Lock-keeper's dwelling completed at Dam No. 1; reconstruction of Dam No. 5 completed and repairs made to lock and approaches; work commenced on the foundations for movable dam and abutment at Beattyville; 29,769 cubic yards gravel, 9,354 cubic yards of rock, and 7,316 snags removed; 10,808 linear feet wing-dams built, '86, 1604, 1605. Operations and repair of locks and dams, '86, 1610.

1886-'87. Construction of Beattyville Dam continued to completion; removal of obstructions continued by the snag-boat, '87, 1873. Operation and repair of locks and dams, '87, 1885.

Projects.

By Maj. Merrill, 1879, for slack-water navigation for a draught of 6 feet on Kentucky River, from mouth to Three Forks, a distance of 258 miles, by repairs to old locks and dams and construction of twelve new locks and dams. Estimated cost, \$1,074,402, '79, 1399; '80, 1826.

In 1883, after an aggregate appropriation of \$550,000, Capt. Post revises the estimates and concludes \$2,471,639.26 is required to complete the project, '83, 1562.

Plan and location of Lock and Dam No. 6, as proposed by Maj. Post, approved by Board of Engineers of 1887, '87, 1880. The Board of Engineers of 1887 considered that the chutes at the Beattyville movable dam do not meet the requirements of navigation and that the stone lock and dam originally contemplated should be substituted therefor, '87, 1881, 1884.

Surveys.

For location of lock and dam at Beattyville, '83, 1560.

Of open river from Oregon to Beattyville, '85, 1871.

MAPS.

'83, 1562; '84, 1744, 1746.

KENTUCKY RIVER, KY.—LOCK AND DAM AT BEATTYVILLE.

(See KENTUCKY RIVER AND ITS TRIBUTARIES.)

KEWAUNEE HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 274.)

Appropriations.

1881.....	\$5,000, '81, 2081.
1882.....	12,000, '82, 2142.
1884.....	18,000, '84, 1850.
1886.....	10,000, '86, 1665.

Total..... 45,000

1888..... 10,000, act of August 11, 1888.

Contracts.

1881. Green Bay Dredge and Pile Driver Company, for pier extension, '81, 2081.

1882. Hanson & Scove, pile-pier construction, '83, 1683.

1884. Schwarz & Berner, for pile-pier construction, '85, 1993.

1886. Schwarz & Berner, for pier extension, '87, 2041.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 207; '81, 276, 279; '82, 272; '83, 281; '84, 280; '85, 303; '86, 297; '87, 263.

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert, 1880-'83. Reports, '81, 2080, 2082; '82, 2141.

Maj. J. W. Barlow, 1883. '83, 274.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1682.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1849; '85, 1993.

Capt. C. E. L. B. Davis 1886-'—. Reports, '86, 1663; '87, 2040.

ASSISTANT.

L. Y. Schermerhorn. Report, '81, 2084.

KEWAUNEE HARBOR, WIS.—Continued.**Operations.**

- 1830-'81. Pier construction commenced under contract, '81, 2080.
 1881-'82. 250 linear feet pile-pier built on north side and 275 feet on south side, '82, 2141.
 1882-'83. 100 linear feet revetted pile-pier built, '83, 1683.
 1883-'84. 350 linear feet north pile-pier built, '84, 1850.
 1884-'85. Work on south pile-pier continued, '85, 1993.
 1885-'86. South pile-pier extended 500 feet; 116,976 cubic yards material dredged from channel by United States dredge, '86, 1664.
 1886-'87. 100 linear feet pier extension wholly and 150 partially completed; 9,035 cubic yards material dredged from the harbor, '87, 2040.

Private and Corporate Work.

- \$5,000 raised in Kewaunee and West Kewaunee to aid in work of improvement, '81, 2080.

Projects.

- By Maj. Robert, 1881, for construction of two parallel pile and crib piers, 1,650 feet long each and 200 feet apart, extending from the shore-line to the 18-foot curve, and located at the point where the Kewaunee River first approaches the lake and turns to the north; also dredging in the channel between the piers and interior basin. Estimated cost, \$200,000, '81, 2083, 2084.

Surveys.

- Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. Robert, '81, 2082.

Maps.

- '81, 2084.

KEYPORT HARBOR, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 274.)

Appropriations.

- 1882..... \$30,475, '83, 589.

Contracts.

- Atlantic Dredging Company, for dredging, at 24 cents per cubic yard, '83, 589.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '83, 111; '84, 120; '85, 111; '86, 105; '87, 73.

ENGINEERS IN CHARGE.

- Lieut. Col. G. L. Gillespie, 1883-'86. Reports, '83, 588; '84, 758; '85, 763.
 Lieut. Col. W. McFarland, 1886. Report, '86, 760.
 Lieut. G. McC. Derby, 1886-'— . Report, '87, 776.

Operations.

- 1882-'83. 1,863 cubic yards material dredged from the channel, '83, 589.
 1883-'84. 112,299 cubic yards material dredged from the channel, '84, 758.
 1884-'87. No operations, '85, 764; '86, 761; '87, 776.

Projects.

- By Lieut. Col. Newton, 1873, for improvement of harbor by excavation of a channel 4,700 feet in length, 200 feet in width, and having a mean low-water depth of 8 feet. Estimated cost, \$30,475, '73, 942. Revised as to cost in 1884 to \$40,475, '84, 759; '87, 776.

KEY WEST HARBOR, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 274.)

Appropriations.

- 1882..... \$25,000, '83, 972.
 1886..... 2,500, '86, 1145.
 1888..... 25,000, act of August 11, 1888.

Contracts.

1883. S. N. Kimball, for dredging, at \$1.30 per cubic yard, '83, 972.

KEY WEST HARBOR, FLA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 185; '83, 187; '84, 195; '85, 195; '86, 194; '87, 156.

ENGINEERS IN CHARGE.

Maj. A. N. Dainrell, 1881-'85. Reports, '82, 1314; '83, 972; '84, 1166.

Capt. W. T. Russell, 1885-'86. Report, '85, 1267.

Capt. W. M. Black, 1886-'— . Reports, '86, 1144; '87, 1221.

ASSISTANTS.

T. L. Harrison. Report, '82, 1315.

J. W. Sackett. Report, '87, 1226.

Operations.

1883-'84. 15,692 cubic yards material dredged from the cut through the bar in formation of a cut 60 feet wide and 15 feet deep, '84, 1167; '87, 1221.

1884-'86. No operations for lack of funds, '85, 1268; '86, 1145.

1886-'87. Survey of entrance to harbor, '87, 1221.

Physical Characteristics.

Description of harbor, '87, 1222.

Tidal volumes and velocities, '87, 1223, 1229.

Plans.

By Capt. Black, 1887, for the improvement of the channel by a dike or breakwater along the west side of the bar. Estimated cost, \$590,000, '87, 1224, 1226.

Projects.

By Capt. Damrell, 1882, for improvement of northwest channel by excavation of a cut 390 feet wide at top and 17 feet deep at mean low water. Estimated cost, \$140,000, '82, 1314.

Channel 60 feet wide and 15 feet deep formed in 1883-'84, '84, 1167; '87, 1221.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Damrell, '82, 1314.

Survey ordered by act of August 5, 1886. Made under direction of Capt. Black, '87, 1221.

MAPS.

Of Northwest Channel Bar, '87, 1234.

LAC LA BELLE HARBOR, MICH.—SURVEY OF.

(Continued from Vol. I, p. 275.)

Commerce.

Commercial statistics, '85, 2007.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 307.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow. Report, '85, 2005, 2007.

Physical Characteristics.

Locality described, '85, 2006.

Plans.

By Col. Barlow, 1885, for repairs to piers and canal built by a corporate company, and deepening the channel by dredging between the piers and through the canal. Estimated cost, \$25,000. Or for the construction of a harbor of refuge, providing for a channel of entrance thereto 18 feet deep. Estimated cost, \$114,000, '85, 2008, 2009.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Col. Barlow, '85, 2005.

LAGRANGE BAYOU, FLA.—IMPROVEMENT OF.**Appropriations.**

1882.....	\$2,000, '83, 1000.
1886.....	2,000, '86, 1179.
1888.....	3,000, act of August 11, 1888, including Holmes River to Vernon.

Commerce.

Amount of, to be benefited by improvement, '82, 1318.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 185; '83, 192; '84, 201; '85, 206; '86, 204; '87, 164.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1881-'85. Reports, '82, 1318; '83, 1000; '84, 1192.

Capt. R. L. Hoxie, 1885-'— . Reports, '85, 1312; '86, 1179; '87, 1268.

ASSISTANT.

H. Haines. Report, '82, 1318.

Operations.

1883-'84. 208 snags, logs, and trees and 3,519 cubic yards mud removed, '84, 1192.

1884-'85. Dredging and removal of obstructions continued, '85, 1312.

1885-'87. No operations, '86, 1178, '87, 1268.

Projects.

By Maj. Damrell, 1881, for improvement of the bayou by deepening the channel through it to the depth of 4½ feet existing through the "Narrows." Estimated cost, \$19,944, '82, 1318; '87, 1268.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1881, under direction of Capt. Damrell, '82, 1318.

LAKE BISTENEAU, LA. (See BAYOU LOGGY, LAKE BISTENEAU, AND THE DORCHEAT, LA.)**LAKE CHAMPLAIN, N. Y. AND VT.—SURVEY AND IMPROVEMENT OF NARROWS.****Appropriations.**

1886.....	\$30,000, '87, 2412.
1888 (from Benson to Whitehall)....	15,000, act of August 11, 1888.

Commerce.

Justification of improvement, '85, 2310.

Contracts.

1886. L. Whitney, for rock removal at the Elbow, '87, 2412.

J. L. Johnson, for dredging in Kinyon's Bay, '87, 2412.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 357; '87, 316.

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert. Report, '85, 2310, 2314.

Maj. M. B. Adams. Report, '87, 2411.

ASSISTANT.

W. P. Judson. Report, '85, 2312, 2315.

Operations.

1886-'87. Rock removal at the Elbow and dredging in Kinyon's Bay in progress, '87, 2412.

Physical Characteristics.

Description of locality, '85, 2312, 2315.

Projects.

By Lieut. Col. Robert, 1885, for the formation of a channel 150 feet wide and 12 feet deep from the Elbow to Whitehall by dredging and rock removal at an estimated cost of \$30,000, '85, 2312, 2313. Also, the formation, by dredging, of a channel 200 feet wide and 12 feet deep from Four Channels to Benson's Landing, at an estimated cost of \$50,000, '85, 2315, 2318.

* Allotted from appropriation for Choctawhatchee River.

LAKE CHAMPLAIN, N. Y. AND VT.—Continued.**Surveys.**

Ordered by act of July 5, 1884. Made under the direction of Lieut. Col. Robert, '85, 2310, 2314.

MAPS.

In vicinity of Whitehall, '85, 2312; '87, 2411.

In vicinity of Four Channels, '85, 2316.

LAKE CHAMPLAIN—SURVEY OF CHANNEL BETWEEN NORTH AND SOUTH HERO ISLANDS.

[\$10,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 115; '82, 116; '87, 317.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie. Report, '82, 717.

Maj. M. B. Adams. Report, '87, 2412.

ASSISTANTS.

D. White. Report, '82, 718.

J. C. Churchill. Report, '87, 2413.

Physical Characteristics.

Description of locality, '82, 717; '87, 2413.

Plans.

By Maj. Gillespie, to widen the existing channel to 250 feet by dredging. Estimated cost, \$3,000, '82, 718, 719.

By Maj. Adams, 1886, for the formation of a dredged channel 150 feet wide and 10 feet deep. Estimated cost, \$14,300, '87, 2413.

Surveys.

Ordered by act of March 3, 1881, and Senate resolution of January 13, 1887. Made under direction of Maj. Gillespie, '82, 717. Also Maj. Adams, '87, 2412.

LAKE CITY, MINN.—HARBOR OF REFUGE AT.

(See LAKE PEPIN, MISSISSIPPI RIVER.)

LAKE ERIE, WABASH, AND OHIO RIVERS—CANAL CONNECTING.

(See CANAL FROM LAKE ERIE TO WABASH AND OHIO RIVERS.)

LAKE PALMYRA, LA. AND MISS.—EXAMINATION OF MOUTH.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 227.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1370.

ASSISTANT.

T. M. Farrell. Report, '84, 1371.

Plans.

In 1883 Capt. Miller, in view of the small amount of commerce involved, did not consider the locality worthy of improvement nor the work a public necessity, '84, 1371.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Capt. Miller, '84, 1370.

LAKE PEPIN, MISSISSIPPI RIVER—HARBOR OF REFUGE IN.**Appropriations.**

1882..... \$20,000, '83, 1404.
 1884..... 30,000, '84, 396, 403, 1570.
 1886..... 10,000, '86, 1424.

Commerce.

Necessity for harbor of refuge, '82, 1795; '83, 1404.

Contracts.

1885. H. E. Stevens, for breakwater construction at Stockholm, '85, 1688, 1690.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 238; '82, 235; '83, 237; '84, 240; '85, 262; '86, 251; '87, 222.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1881. Reports, '82, 1794; '83, 1404; '84, 1570; '85, 1687; '86, 1422, 1424; '87, 1657.

Operations.

1884-'85. Construction of 135 linear feet of earth embankment and 230 feet of crib construction at Stockholm, '85, 1688.

1885-'86. Extension of breakwater to a length of 579 feet, '86, 1422.

1886-'87. No operations, '87, 1658.

Projects.

By Maj. Mackenzie, 1882, for the formation of harbors of refuge at Lake City, Minn., and Stockholm, Wis., by the extension from the shore of a breakwater at each locality 1,000 feet long. Estimated cost, \$228,000, '82, 1796; '83, 237.

Surveys.

For harbor of refuge ordered by act of June 14, 1880, '81, 238. Made under direction of Maj. Mackenzie, 1881, '82, 1794.

LAKE TRAVERSE, MINN. (See BIG STONE LAKE AND LAKE TRAVERSE, MINN.)**LAKE WINNIBIGOSHISH—EXPERIMENTAL DAM AT.**

(See MISSISSIPPI RIVER, RESERVOIRS AT HEADWATERS OF.)

LAKE WINIPISEOGEE, N. H.—IMPROVEMENT OF OUTLET.

(Continued from Vol. I, p. 277.)

Appropriations.

1880..... \$5,000, '80, 340.
 1881..... 2,500, '81, 494.

Contracts.

1880. Winipiseogee Lake Manufacturing Company, for dredging, at \$1 per cubic yard, '81, 495.

1881. Winipiseogee Lake Manufacturing Company, for dredging, at \$1 per cubic yard, '81, 495.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72; '81, 71; '82, 69; '83, 64; '85, 60.

ENGINEERS IN CHARGE.

Cbl. G. Thom, 1879-'83. Reports, '80, 339, 362; '81, 492; '82, 501.

Col. C. E. Blunt, 1883-'85. Reports, '83, 423; '85, 479.

Operations.

1880-'81. 400 cubic yards material dredged from the lake, '81, 494.

1881-'82. 1,540 cubic yards material dredged from the lake, '81, 494.

1882-'83. 1,285 cubic yards material dredged, '83, 424.

Physical Characteristics.

Description of lake, '81, 493.

LAKE WINIPISEOGEE, N. H.—Continued.**Projects.**

By Col. Thom, 1879, for excavation of a channel 50 feet wide and 5 feet deep at extreme low water, through the outlet from Lake Winipiseogee to Long Bay. Estimated cost, \$7,500, '80, 363.

Surveys.

Of outlet of Lake Winipiseogee ordered by act of March 3, 1879. Made, 1879, under direction of Col. Thom, '80, 362.

Examination of Winipiseogee Lake at "the Weirs" ordered by act of July 5, 1884. Made, 1884, under direction of Col. Blunt. Reported as unworthy of improvement, '85, 479.

MAPS.

'80, 362.

LAKE WORTH, FLA. (See INDIAN RIVER, FLA.)**LAMPREY RIVER, N. H.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 277.)

Appropriations.

1881..... \$10,000, '81, 496.
1882..... 10,000, '82, 503.

Commerce.

Extent of prospective benefit to commerce, '81, 495.

Contracts.

1882. T. Symonds, for dredging, at 65 cents per cubic yard, '83, 426.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 70; '82, 69; '83, 64; '84, 73.

ENGINEERS IN CHARGE.

Col. G. Thom, 1881-'83. Reports, '81, 495; '82, 502.

Col. C. E. Blunt, 1883-'84. Reports, '83, 424; '84, 472.

Operations.

1881-'82. 2,000 tons of bowlders removed from the channel, '82, 503.

1882-'83. 12,956 cubic yards material dredged and 330 cubic yards bowlders removed, '83, 425. The proposed improvement essentially finished, '84, 73.

Projects.

By Col. Thom, 1874, for improvement of the river, giving a channel with a depth of 12 feet at mean high water from its mouth up to the Lower Narrows, for a width of not less than 100 feet, thence up to the New Market Wharves, a depth of 11 feet at mean high water, for a width of not less than 40 feet. Estimated cost, \$24,000, '81, 495.

L'ANGUILLE RIVER, ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 278.)

Appropriations.

1878-'79..... \$15,000
1880..... 2,000, '80, 1315.

Commerce.

Demands of commerce do not require further appropriations, '82, 215; '86, 1389.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 154; '81, 217; '82, 215; '83, 222; '84, 231; '85, 251; '86, 243; '87, 209.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benysaard, 1878-'81. Reports, '80, 1315; '81, 1434.

Maj. T. H. Handbury, 1881-'83. Reports, '81, 1514; '82, 1582; '83, 1171.

Maj. M. B. Adams, 1883-'84. Report, '84, 1403.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1600; '86, 1388; '87, 1543.

L'ANGUILLE RIVER, ARK.—Continued.**Operations.**

- 1879-'80. None, '80, 1315.
 1880-'81. Removal of snags and overhanging trees, '81, 1434.
 1881-'82. Removal of snags and overhanging trees, '82, 1582.
 1882-'85. No operations, '83, 1171; '84, 1403; '85, 1600.
 1885-'86. Removal of snags and trees, '86, 1389.
 1886-'87. Removal of snags and trees continued, '87, 1544.

Projects.

By Maj. W. H. H. Benyaard, 1879, for the improvement of the river by the removal of logs, snags, and overhanging trees, '79, 969. Accomplished in 1882 by the expenditure of about \$14,000, and subsequent funds held for future contingencies, '85, 1600. No further appropriations recommended at present, '86, 1389.

LAWRENCBURGH HARBOR, IND.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 285.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1839, 1840.

Plans.

By Lieut. Col. Merrill, 1885, for the removal of a part of the projecting bar at the mouth of the Great Miami River. Estimated cost, \$20,000, '85, 1842.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Merrill, '85, 1840.

LEIPSIC RIVER, DEL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 138.

ENGINEER IN CHARGE.

Lieut. Col. G. Weitzel. Report, '84, 854.

ASSISTANT.

E. A. Giesler. Report, '84, 854.

Plans.

In 1882 Col. Weitzel did not consider the river worthy of improvement nor the work a public necessity, '84, 854.

Surveys.

Examination ordered by act of August 2, 1884. Made under direction of Lieut. Col. Weitzel, '84, 854.

LEONARDTOWN HARBOR (Breton Bay), MD.—IMPROVEMENT OF.**Appropriations.**

1878-'79	\$9,000
1880	3,000, '80, 756.
1881	3,000, '81, 951.
1882	5,000, '82, 1012.
1884	3,000, '84, 981.
1886	6,500, '86, 902.

Total..... 29,500

1888..... 3,000, act of August 11, 1888.

Contracts.

1879. G. C. Fobes & Co., for dredging, at 16 cents per cubic yard, '80, 756.
 1880. National Dredging Company, for dredging, at 15 cents per cubic yard, '81, 950.
 1881. National Dredging Company, for dredging, at 15½ cents per cubic yard, '82, 1011.

LEONARDTOWN HARBOR (Breton Bay), MD.—Continued.**Contracts—Continued.**

1882. Potomac Dredging Company, for dredging, at 18 cents per cubic yard, '83, 797.
 1884. T. P. Morgan, for dredging, at 12 cents per cubic yard, '85, 964.
 1886. National Dredging Company, for dredging, at 11 cents per cubic yard, '87, 930.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 112; '81, 152; '82, 147; '83, 152; '84, 155; '85, 145; '86, 140; '87, 107.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1878-'— Reports, '80, 756; '81, 949; '82, 1009; '83, 797; '84, 981; '85, 964; '86, 901; '87, 928.

Operations.

1879-'80. 21,600 cubic yards dredged from basin and channel, '80, 756.

1880-'81. 17,976 cubic yards dredged from channel and basin, '81, 950.

1881-'82. 16,256 cubic yards dredged from basin, '82, 1011.

1882-'83. 22,048 cubic yards dredged from channel and basin, '83, 798.

1883-'84. No operations for lack of funds, '84, 981.

1884-'85. 20,359 cubic yards dredged from channel and basin, '85, 964.

1885-'86. No operations for lack of funds, '86, 902.

1886-'87. 40,930 cubic yards material dredged, '87, 930.

Projects.

By Lieut. Col. Craighill, 1875, for the formation of a dredged channel 150 feet wide and 9 feet deep from the Breton Bay to Leonardtown wharf. Estimated cost, \$30,000, '75, ii, 108; '80, 757. After an expenditure of \$23,000, S. T. Abert proposed in 1885 an amended project, whereby the channel was to be widened to 200 feet and the basin at Leonardtown to 400 feet; the basin and channel to be not less than 10 feet deep. Estimated cost, \$26,000, '85, 965.

Surveys.**MAPS.**

'87, 930.

LEWIS AND CLARKE'S RIVER, OREG. (See YOUNG'S, LEWIS AND CLARKE'S RIVERS.)**LEWES, DEL.—CONSTRUCTION OF PIER NEAR.**

(Continued from Vol. I, p. 229.)

Appropriations.

1870-'79	\$335,500
1880	10,000, '80, 607.
1881	10,000, '81, 816.
1882	13,000, '82, 782.

Total 368,500

Contracts.

1881. Eppinger & Russell, for pine timber and creosoted piles, '81, 818.
 1882. Eppinger & Russell, for pine timber, at \$27.25 and \$31 per M, '82, 782; '83, 655.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 96; '81, 127; '82, 124; '83, 128; '84, 137; '85, 121; '86, 118; '87, 80.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'81. Reports, '80, 605; '81, 815.

Capt. W. Ludlow, 1881-'82. Report, '82, 781.

Lieut. Col. G. Weitzel, 1882-'84. Report, '83, 654.

Lieut. T. L. Casey, jr., March 19 to April 19, 1884, '84, 792.

Maj. W. H. Hener, 1884-'85. Report, '84, 843.

Lieut. Col. H. M. Robert, 1885-'— Reports, '85, 845; '86, 836; '87, 804.

ASSISTANTS.

Capt. W. Ludlow. Report, '81, 818.

A. Stierle. Report, '82, 782.

J. M. Stewart. Reports, '83, 655; '84, 844.

LEWES, DEL.—Continued.**Legislation.**

Senate resolution of March 12, 1886, directing an estimate to be made as to probable cost of an iron superstructure, '86, 837.

Operations.

1879-'80. Redriving iron piles in 57th row and placing of 52 sets of horizontal braces; superstructure replaced on part of pier, '80, 605.

1880-'81. 78 Fender-piles placed at pier-head and timber superstructure partially renewed, '81, 1815.

1881-'82. 107 Fender-piles placed and timber superstructure partially renewed, '82, 783.

1882-'83. Timber superstructure replaced over 500 linear feet of pier; iron rails purchased for railroad track for full length of pier, '83, 655.

1883-'84. Replacing timber superstructure in progress; railroad track laid for full length of pier, '84, 844.

1884-'87. No operations, '85, 845; '86, 836; '87, 804.

Plans.

By Lieut. Col. Robert, 1886, for an iron superstructure suitable for the requirements of the pier if subjected to railroad traffic. Estimated cost, from \$93,000 to \$115,000, '86, 838; '87, 805.

Projects.

By Lieut. Col. Kurtz, 1871, for a landing-pier in Delaware Bay, near Lewes, Del., about 1,800 feet long, with floor 13 feet above mean low water. From the shore end outward for a distance of 1,200 feet the pier to be 22 feet wide, and from thence to the outer end 43 feet wide; the superstructure to consist of iron screw-piles from 22 to 45 feet long and $5\frac{1}{2}$ to 8 inches in diameter; the superstructure carrying the floor to be of wood. Estimated cost, \$278,423.78, '71, 670-680. Increased to \$387,413.67, '74, ii, 133, 134.

The substructure was completed in 1880, '80, 606.

The total amount appropriated has been \$368,500, '86, 837.

See also PLANS.

LEWIS RIVER, WASH.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '83, 342; '85, 372.

ENGINEERS IN CHARGE.

Capt. C. F. Powell. Report, '84, 2293.

Maj. W. A. Jones. Report, '85, 2444.

Plans.

In 1883 Capt. Powell considered a part of the river worthy of minor improvement, but that the work was not a public necessity, '84, 2293.

In 1884 Maj. Jones considered the river worthy of improvement at an annual cost of \$1,000 for the removal of snags, '85, 2444.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Powell, '84, 2293.

Examination ordered by act of July 5, 1884. Made under direction of Maj. Jones, '85, 2444.

LEXINGTON, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**LICKING RIVER, KY.**—EXAMINATION OF.

(Continued from Vol. I, p. 280.)

[\$3,000 appropriated by act of August, 11, 1888.]

Commerce.

Commercial statistics, '82, 1966.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 265; '82, 260; '85, 285; '87, 249.

LICKING RIVER, KY.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. J. W. Cuyler. Report, '82, 1964.

Lieut. Col. W. E. Merrill. Report, '85, 1843.

Maj. J. C. Post. Report, '87, 1902.

Plans.

In 1882 Maj. Cuyler considered that the radical improvement could only be accomplished by locks and dams at an estimated cost of \$684,000, '82, 1965.

By Lieut. Col. Merrill, 1885, for the connection of navigation of the Licking with that of the Ohio river by the removal of the bar at the mouth of the former. Estimated cost, \$75,000, '85, 1844.

By Maj. Post, 1887, for an improvement, extending from Farmers to West Liberty, by removal of snags and similar obstructions. Estimated cost, \$17,680, '87, 1903.

Surveys.

Examination ordered by act of June 14, 1880. Made under the direction of Maj. Cuyler, '82, 1964.

Previous surveys, '82, 1964.

Of bar at mouth of the river ordered by act of July 5, 1884. Made under direction of Lieut. Col. Merrill, '85, 1843.

From Farmers to West Liberty ordered by act of August 5, 1886. Made under direction of Maj. Post, '87, 1902.

LILLINGTON RIVER, N. C.—IMPROVEMENT OF.**Appropriations.**

1881..... \$3,000, '81, 1021.

1882..... 3,000, '82, 1101.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 165; '82, 160; '83, 168; '84, 173.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'82. Report, '81, 1020, 1021.

Capt. J. Mercur, 1882-'84. Reports, '82, 1101; '83, 860.

Capt. F. A. Hinman, 1884. Report, '84, 1044.

ASSISTANTS.

J. P. Darling. Report, '81, 1022.

W. H. James. Reports, '83, 861; '84, 1044.

Operations.

1882-'83. River cleaned of snags and obstructions from mouth to Lillington; cut-off dredged, '83, 861.

1883-'84. Dredging of cut-offs completed to a depth of from 6 to 10 feet at low water; projecting points cut off and a small island removed; completing improvement proposed, '84, 1044.

Projects.

By Capt. Phillips, 1881, for improvement from mouth to Lillington, a distance of 11 miles, by removal of snags, logs, and trees, and three projecting points of land, and dredging cut-offs so as to give the river a navigable depth of 5 feet. Estimated cost, \$6,003, '81, 1022. Completed in 1884, '84, 1044.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Phillips, '81, 1020.

MAPS.

'83, 860.

LIMESTONE CREEK, KY.—EXAMINATION OF BAR AT MOUTH OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 244.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1887. Report, '87, 1834.

ASSISTANT.

Lieut. L. H. Beach. Report, '87, 1834.

LIMESTONE CREEK, KY.—Continued.**Plans.**

Lieut. Col. Merrill, 1887, reports the locality as unworthy of improvement, '87, 1834.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Merrill, '87, 1834:

LINK HORN BAY, VA. (See BROAD BAY.)**LINK RIVER, OREGON.**

Examination ordered by act of August 5, 1886, '87, 330.

LITTLE CREEK, DEL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 98; '81, 129.

ENGINEER IN CHARGE.

Col. J. N. Maccomb. Report, '80, 829.

ASSISTANT.

W. S. Edwards. Report, '80, 829.

Plans.

By Col. Maccomb, 1880, for improvement from mouth to Little Creek Landing, 3½ miles, by excavation of channel 6 feet deep and 40 feet wide, with four short canals across sharp bends in the creek. Estimated cost, \$17,200, '81, 830.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Maccomb, '80, 829.

LITTLE HARBOR AT PORTSMOUTH, N. H.—SURVEY AND IMPROVEMENT OF.**Appropriations.**

1886..... \$10,000, '86, 60.

1888 (harbor of refuge).... 20,000, act of August 11, 1888.

Commerce.

Necessity for harbor of refuge, '85, 483, '87, 469.

Contracts.

1887. Moore & Wright, for dredging, at 24 cents per cubic yard, '87, 468.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 60, 480; '86, 59; '87, 21.

ENGINEERS IN CHARGE.

Col. G. Thom. Report, '82, 507.

Col. C. E. Blunt. Report, '85, 480.

Maj. J. A. Smith, 1886.—. Report, '87, 468.

Operations.

1886-'87. Contract entered into for dredging 37,500 cubic yards of material, '87, 468.

Plans.

By Col. Blunt, for the conversion of Little Harbor into a larger harbor of refuge by extending area and construction of two breakwaters. Estimated cost, \$154,000, '85, 481.

By Maj. Smith, 1886, for an enlarged harbor, at an estimated cost of \$165,000, '87, 470.

LITTLE HARBOR AT PORTSMOUTH, N. H.—Continued.**Projects.**

By Col. G. Thom, 1882, for dredging a channel of entrance to the inner harbor 9 feet deep at mean low water and 100 feet wide, widening the anchorage basin to 300 feet for a distance of 700 feet and giving additional protection by a small break-water on the ledge at Jerry Point. Estimated cost, \$33,000, '82, 507; '85, 481; '86, 60; '87, 468.

Surveys.

Survey with a view to its improvement for a harbor of refuge ordered by act of July 5, 1884. Made under direction of Col. Blunt, '85, 480.

MAPS.

'87, 470.

LITTLE KANAWHA RIVER, W. VA.—IMPROVEMENT OF.

(See KANAWHA RIVER (LITTLE), W. VA.)

LITTLE KANAWHA RIVER, W. VA.—SURVEY FOR ICE-HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Report, '80, 195.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '80, 1790.

ASSISTANT.

W. E. Strong. Report, '80, 1793.

Private and Corporate Work.

Petition of Little Kanawha Bridge Company with reference to the disposal of their bridge as an obstruction in the river, '80, 1797.

Plans.

By Maj. Merrill, 1880, for construction of two ice-breakers of timber and stone below railroad bridge across the Ohio River. Estimated cost, \$6,000, '80, 1796.

By Maj. Merrill, 1880, for raising wagon bridge near mouth of Little Kanawha River 32 feet and construction of approaches thereto. Estimated cost, \$80,000, '80, 1795.

Modification of above plan. Estimated cost, \$60,000, '80, 1795.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Merrill, '80, 1790.

LITTLE LAKE, LA.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197.

ENGINEER IN CHARGE.

Maj. C. W. Howell. Report, '80, 1307.

ASSISTANT.

H. S. Douglass. Report, '80, 1308.

Plans.

By Maj. Howell, 1881, for channel 50 feet wide and 5 feet deep from New Orleans to Barataria.

Route 1. Clearing obstructions from Bayou Barataria and dredging channel at Pointe le Garde and at head and mouth of Bayou St. Denis. Estimated cost, \$78,486, '81, 1314.

Route 2. Clearing Bayous Barataria and Dupont, cutting canals at Bayou Dupont, and connecting Bayous Dupont and Cutler. Estimated cost, \$108,158, '81, 1314.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. Howell, '81, 1307.

LITTLE NARRAGANSETT BAY, R. I. AND CONN.

(See NARRAGANSETT BAY (LITTLE), R. I. AND CONN.)

LITTLE PEE DEE RIVER. (See PEE DEE (LITTLE) RIVER.)**LITTLE RED RIVER, ARK.** (See RED RIVER, LITTLE.)**LITTLE RIVER, ARK.—EXAMINATION OF.****Commerce.**

Commercial statistics, '84, 1407, 1408.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 232; '87, 210.

ENGINEERS IN CHARGE.

Capt. J. H. Handbury. Report, '84, 1406.

Capt. H. S. Taber. Report, '87, 1545.

Physical Characteristics.

River described, '84, 1407.

Plans.

In 1882 Capt. Handbury did not consider the river worthy of improvement nor the work a public necessity, '84, 1407.

In 1887 Capt. Taber, after a re-examination, expressed the same opinion, '87, 1545.

Surveys.

Examination ordered by acts of August 2, 1882, and August 5, 1886, '84, 1406; '87, 1545.

LITTLE RIVER, KY.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 279.

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '85, 1772.

Plans.

In 1884 Maj. King did not consider the river worthy of improvement, '85, 1772.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Maj. King, '85, 1772.

LITTLE RIVER, LA.—EXAMINATION OF.

[\$2,500 appropriated by act of August 11, 1888.]

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 203.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887. Report, '87, 1498.

Physical Characteristics.

Description, '87, 1498.

Plans.

Capt. Willard estimates \$2,500 as the sum required for clearing the river of obstructions, '87, 1499.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Willard, '87, 1498.

LITTLE RIVER, MO., from Homersville to its junction with the Saint Francis—EXAMINATION OF.

[\$5,000 appropriated by act of August 11, 1883.]

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 210.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1887. Report, '87, 1548.

Plans.

By Capt. Taber, 1887, for an eight-months navigation to Homersville by dam construction and snag removal. Estimated cost, \$8,000, '87, 1549.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Capt. Taber, '87, 1548.

LITTLE SODUS HARBOR, N. Y. (See SODUS HARBOR (LITTLE), N. Y.)

LITTLE TENNESSEE RIVER, TENN.—IMPROVEMENT OF.

Appropriations.

1882..... \$5,000, '82, 1869.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 258; '82, 252; '83, 259; '84, 259; '85, 278; '86, 270; '87, 232.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1881-'86. Reports, '82, 1868, 1871; '83, 1507; '84, 1659; '85, 1769.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1524; '87, 1752.

ASSISTANT.

J. H. Mayhew. Report, '82, 1872.

Operations.

1882-'83. 110 cubic yards rocks and bowlders excavated from channel; 156 cubic yards riprap dam and 11 cubic yards embankment built; 110 snags and trees removed, '83, 1507.

1883-'84. 1,409 cubic yards rock, bowlders, and gravel, 182 snags, and 421 trees removed, and 1,380 cubic yards rock placed in wing-dams, '84, 1660.

1884-'87. No operations, '85, 1770; '86, 1524; '87, 1753.

Projects.

By Maj. King, 1882, for improvement from its mouth to the mouth of the Tellico River, about 13 miles, by removal of snags, logs, bowlders, and similar obstructions, and construction of stone wing-dams, securing a channel 40 feet wide and 2 feet deep. Estimated cost, \$23,724, '82, 1868, 1869.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Maj. King, '82, 1868.

LITTLE TRAVERSE BAY, MICH.—EXAMINATION FOR HARBOR OF REFUGE AT.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 324.

ENGINEER IN CHARGE.

Capt. D. W. Lockwood. Report, '85, 2095.

Plans.

In 1884 Capt. Lockwood did not consider the locality worthy of improvement, '85, 2095.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Lockwood, '85, 2095.

LLOYD'S HARBOR AND COLD SPRINGS BAY, N. Y. (See CHANNEL BETWEEN LLOYD'S HARBOR AND COLD SPRINGS BAY, N. Y.)

LOCKWOOD'S FOLLY RIVER, N. C.—SURVEY OF.

(Continued from Vol. I, p. 283.)

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 125; '87, 139.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips. Report, '80, 909.

Capt. W. H. Bixby. Report, '87, 1099.

ASSISTANTS.

C. W. Forster. Report, '80, 910.

J. H. Bacon. Report, '87, 1101.

Plans.

By Capt. Phillips, 1880, for improvement of river for a distance of 20 miles from its mouth by dredging a channel 75 feet wide, 8 feet deep, and 2,100 yards long through bar at mouth, also closing cut-off below Mercer's Landing. Estimated cost, \$17,379.95, '80, 909.

By Capt. Bixby, 1887, for the formation of a dredged channel 7 feet deep and 100 feet wide from the mouth to the head of navigation at Lockwood's Folly Bridge. Estimated cost, \$40,000, '87, 1101.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 909. Ordered by act of August 5, 1886. Made under direction of Capt. Bixby, '87, 1100.

MAPS.

'87, 1100.

LOGGY BAYOU, LA. (See BAYOU LOGGY, LAKE BISTENEAU, AND THE DORCHEAT, LA.)

LONG BEACH, N. Y. (See BALDWIN RIVER, N. Y.)

LONG BRANCH, N. J.—EXAMINATION FOR BREAKWATER AT.

Commerce.

No requirement for harbor of refuge, '84, 764.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 122.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie. Report, '84, 763.

Plans.

Lieut. Col. Gillespie did not consider the locality worthy of improvement, '84, 764.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Lieut. Col. Gillespie, '84, 123.

LOOSASCOONA RIVER, MISS.—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 226.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1344.

LOOSASCOONA RIVER, MISS.—Continued.**Engineers—Continued.****ASSISTANT.**

W. S. Davis. Report, '84, 1344.

Plans.

In 1883 Capt. Miller did not consider the river worthy of improvement nor the work a public necessity, '84, 1344.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Miller, '84, 1344.

LOUISA FORK OF SANDY RIVER, VA. (See BIG SANDY RIVER.)**LOUISIANA, MO. (See MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER.)****LOWER CLEARWATER RIVER, IDAHO—IMPROVEMENT OF.**

(See CLEARWATER RIVER, IDAHO.)

LOWER WILLAMETTE AND COLUMBIA RIVERS, OREG.—IMPROVEMENT OF.

(See WILLAMETTE AND COLUMBIA RIVERS, OREG.)

LUBEC CHANNEL, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 283.)

Appropriations.

1879.....	\$44,000
1880.....	20,000, '80, 327.
1881.....	45,000, '81, 460.
1882.....	20,000, '82, 488.
1884.....	10,000, '84, 461.
1886.....	10,000, '86, 530.

Total	149,000
1888.....	20,000, act of August 11, 1888.

Contracts.

1880. Atlantic Dredging Company, for dredging, '80, 328.
 1881. Moore & Wright, for dredging, '81, 460.
 1882. Moore & Wright, for dredging, at 37 cents per cubic yard, '82, 488.
 1884. W. S. White, for jetty construction, '84, 461. Moore & Wright, for dredging, at 42 cents per cubic yard, '85, 464. G. W. Townsend, for rock removal, at \$24.90 per cubic yard, '85, 462.
 1887. Moore & Wright, for dredging, at 35 cents per cubic yard, '87, 437.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 63; '81, 64; '82, 63; '83, 59; '84, 67; '85, 55; '86, 54; '87, 14.

ENGINEERS IN CHARGE.

Col. G. Thom, 1879-'83. Reports, '80, 325; '81, 459; '82, 486.

Col. C. E. Blunt, 1883-'86. Reports, '83, 407; '84, 460; '85, 462.

Maj. J. A. Smith, 1886—'. Reports, '86, 527; '87, 436.

LUBEC CHANNEL, ME.—Continued.

Operations.

- 1879-'80. 3,720 cubic yards material dredged, '80, 326; '81, 459.
 1880-'81. 13,327 cubic yards dredged, '81, 459; '82, 487.
 1881-'82. 41,330 cubic yards material dredged, '82, 64, 4-7.
 1882-'83. 45,831 cubic yards material dredged from channel, '83, 408.
 1883-'84. No operations, '84, 460.
 1884-'85. 134 linear feet stone jetty built; rock removal commenced; 23,272 cubic yards material dredged, '85, 462.
 1885-'86. 5,792 cubic yards material dredged, '86, 528.
 1886-'87. 966 cubic yards material dredged from the channel, '87, 436.

Projects.

- By Lieut. Col. Thom, 1879, for improvement of bars between the Narrows and Western Bar Beacon, a distance of 2½ miles, by widening the channel to 200 feet and deepening to 12 feet. Estimated cost, \$48,000, '79, 44, 246, 230, 282. Revised in 1880 to \$130,000, '80, 326. Amended in 1881 and 1882 to \$154,000, '81, 460; '82, 487.
 From 1879 to 1882, inclusive, \$129,000 was appropriated.
 In 1883 Col. Blunt proposed increasing the width of channel to 275 feet and depth to 15 feet, at an estimated cost of \$113,000, '83, 409; '85, 463.
 In 1884 the aggregate of appropriations was \$139,000, when the estimate to complete was amended to \$167,500, '86, 529.

Surveys.**MAPS.**

'84, 460.

LUDINGTON HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 284.)

Appropriations.

1867-'79	\$196, 185
1880	8, 000, '80, 2014.
1881	10, 000, '81, 2209.
1882	12, 000, '82, 2291.
1884	10, 000, '84, 1978.
1886	56, 250, '86, 1761.
Total	292, 435
1888	60, 000, act of August 11, 1888.

Commerce.

Vessels lost between Big and Little Point Sable, between 1848 and 1881, '82, 2300.

Contracts.

1879. Dewar & Corlett, materials and labor, '80, 2014. D. Dewar, for pier extension, superstructure, and dredging, '81, 2208.
 1881. D. Dewar, for pier construction and dredging, '82, 2291.
 1882. T. H. Smith, for dredging, at 29 cents per cubic yard, '83, 1816.
 1883. C. E. Mitchell, for crib construction, '85, 2074.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 215; '81, 292; '82, 286, 2292; '83, 294; '84, 295, 301; '85, 317, 324, 2090; '86, 312; '87, 279.

BOARD OF ENGINEERS.

Convened by S. O. No. 181, C. of E., 1884, to report upon a plan with estimate for harbor of refuge at Ludington, Mich. '85, 2073. (Lieut. Cols. Poe and Barlow and Capt. Lockwood.)

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1880-'82. Reports, '80, 2013; '81, 2208; '82, 2203.
 Maj. D. P. Heap, 1882-'83. Report, '82, 2291.
 Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1815; '84, 1977; '85, 2072, 2091; '86, 1761; '87, 2184.

Operations.

- 1879-'80. 100 linear feet crib-work placed in pier extension, '80, 2013.
 1880-'81. 122 cords stone used in refilling south pier; piers and revetments made sand tight; south pier extended 50 feet, '81, 2208.
 1881-'82. 50 by 30-foot crib sunk in prolongation of south pier; 150 linear feet superstructure built; 5,000 cubic yards sand dredged from bar at mouth of channel, '82, 2290.

LUDINGTON HARBOR, MICH.—Continued.**Operations—Continued.**

- 1882-'83. Outer end of south pier repaired; 100 linear feet superstructure built; 4,020 cubic yards material dredged from channel, '83, 1815.
 1883-'84. 10,338 cubic yards material dredged from between piers; north side of south pier repaired, '84, 1977.
 1884-'85. South pier extended 50 feet and part of the superstructure for same built, '85, 2073.
 1885-'86. 9,990 cubic yards of material dredged from between piers, '86, 1761.
 1886-'87. No operations, '87, 2185.

Plans.

- By Capt. Lockwood, for a harbor of refuge through the construction of an outer breakwater, at an estimated cost of \$361,260, '85, 2091, 2029.

Projects.

- By Maj. Wheeler, 1866, for two parallel crib-piers 200 feet apart extending into the lake 450 feet on north side and 640 feet on south side; repairs to old north slab-pier; removal of old south slab-pier; close piling on south side of crib, and dredging to 12 feet, '67, 25, 114. Estimated cost amended in 1879, \$213,787, '80, 2014; '85, 2074.

Whole amount appropriated from 1867 to 1884, inclusive, \$236,185, '85, 2074.

- By Capt. Lockwood, 1884, for formation of harbor of refuge by widening to 400 feet the present entrance to Pere Marquette Lake by construction of a new south pier and dredging channel to 18 feet. Estimated cost, \$419,185, '84, 2001; '85, 2093. Recommended by Board of Engineers, 1884, '85, 2093.

Surveys.

- For harbor of refuge, '82, 2290.

Maps.

- '82, 2292; '84, 1977.

LUMBER RIVER, N. C.—SURVEY OF.

[\$5,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

- Report, '87, 139.

ENGINEER IN CHARGE.

- Capt. W. H. Bixby, 1887. Report, '87, 1102.

Physical Characteristics.

- Description of the river, '87, 1103.

Plans.

- By Capt. Bixby, 1887, for clearing the river of obstructions so as to permit of a 4 to 6 foot draught steam navigation from its mouth to Lumberton. Estimated cost, \$35,000, '87, 1106.

Surveys.

- Ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Bixby, '87, 1104.

LYNCH'S RIVER, S. C.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

- Reports, '80, 125; '81, 168.

ENGINEER IN CHARGE.

- Capt. C. B. Phillips. Report, '81, 1038.

ASSISTANT.

- J. P. Darling. Report, '81, 1039.

Physical Characteristics.

- Description of river and its obstructions, '81, 1039.

Plans.

- By Capt. Phillips, 1881, for improvement between the Wilmington, Columbia and Augusta Railroad Bridge and its mouth, by removal of snags, logs, and fallen trees. Estimated cost, \$45,000, '81, 1039, 1040.

Surveys.

- Ordered by act of June 14, 1880. Made, 1880, under direction of Capt. Phillips, '81, 1038.

LYNN HARBOR, MASS.—IMPROVEMENT OF.**Appropriations.**

1882.....	\$60,000, '83, 461.
1886.....	6,000, '86, 578.
1888.....	10,000, act of August 11, 1888.

Commerce.

Statistics, '83, 462.

Contracts.

1884. Moore & Wright, for dredging, at 23½ cents per cubic yard, '84, 522.

1886. A. R. Wright, for dredging, at 21½ cents per cubic yard, '87, 510.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 77; '82, 77; '83, 71; '84, 77, 523; '85, 65; '86, 65; '87, 26.

BOARD OF ENGINEERS.

Convened at New York April 10, 1884, to report upon Col. Thom's project for improvement of Lynn Harbor. Report, '84, 524. (Lieut. Cola. Abbot and Comstock.)

ENGINEERS IN CHARGE.

Col. G. Thom, 1881. Report, '82, 544.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 460; '84, 520, 531, 549; '85, 516.

Lieut. Col. G. L. Gillespie, 1886-'— . Reports, '86, 577; '87, 508.

ASSISTANT.

H. F. Bothfield. Report, '84, 531.

Operations.

History of harbor, '84, 538.

1884-'85. 170,445 cubic yards material dredged from the lower and upper channels, '85, 517.

1885-'86. No operations, '86, 578.

1886-'87. 50,089 cubic yards dredged from inner channel, '87, 509.

Physical Characteristics.

Prevailing winds and tidal data, '84, 536, 537.

Current observations, '84, 546.

Plans.

By Col. Thom, for improvement of harbor by means of two rubble breakwaters, '84, 524, 529.

Projects.

By Board of Engineers, 1884, for the formation of a channel 200 feet wide and 10 feet deep at mean low water, from a point near the White Rocks to deep water opposite Little Nahant, and from deep water opposite Sand Point to Lynn Harbor line. The upper part of the channel to be maintained by occasional dredging, the lower part by a training-wall joining the land at Little Nahant. Estimated cost, \$145,000, '84, 521, 528. Cost revised to \$157,000, '85, 517; '87, 509.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Col. Thom, '82, 544.

Of harbor, 1885, '85, 517.

MAPS.

'84, 532.

Of upper channel, '86, 578.

LYNN HAVEN BAY, VA. (See BROAD BAY.)**MACHODOC (UPPER) CREEK, VA.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 158; '82, 154.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '82, 1067.

Plans.

By S. T. Abert, 1882, for excavation of a 7½-foot channel 75 feet wide, from Potomac River to Clannahan's Wharf, \$35,771; for a similar channel from the Potomac River to Milford Landing, \$53,769, '82, 1067, 1068.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of S. T. Abert, '82, 1067.

MACKINAC CITY, MICH.—SURVEY FOR BREAKWATER AT.

(Continued from Vol. I, p. 287.)

Commerce.

Interests of, require protection, '80, 2056.

Decadence of same, '87, 2272.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 221; '85, 332; '87, 294.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1879-'80. Report, '80, 2055.

Lient. Col. O. M. Poe. Reports, '85, 2180; '87, 2271.

Physical Characteristics.

Recession of beaches, '80, 2055.

Plans.

By Maj. Harwood, 1880, for converging piers from Mission and Biddle's Points. Estimated cost from \$125,000 to \$200,000, '80, 2056, 2057.

In 1884 Col. Poe considered that the cost of a breakwater to afford a harbor of refuge would not be less than \$1,500,000, and that the commercial requirements of the locality would not justify such expenditure, '85, 2181.

Lient. Col. Poe, in his examination, 1886, repeats Maj. Harwood's estimate of \$125,000 as cost of breakwater located off Biddle's Point, '87, 2272.

Surveys.

Ordered by act of March 3, 1879, '80, 221. Made under direction of Maj. Harwood, 1880, '80, 2055.

Ordered by act of July 5, 1884. Made under direction of Lient. Col. Poe, '85, 2180.

Examination of Biddle's Point with view to breakwater ordered by act of August 5, 1886. Made under direction of Lient. Col. Poe, '87, 2271.

MADISON HARBOR, CONN.—SURVEY OF.**Commerce.**

Necessity for breakwater at, '82, 629; '84, 635.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 97; '82, 97; '84, 100.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Reports, '82, 671; '84, 685.

ASSISTANT.

H. N. Babcock. Report, '82, 627.

Plans.

By Maj. Barlow, 1882, for the construction of a breakwater covering the landing at Milford. Estimated cost, \$285,000, '82, 627.

Surveys.

Ordered by acts of March 3, 1881, and August 2, 1882. Made under direction of Maj. Barlow, '82, 627; '84, 685.

MALDEN RIVER, MASS.—IMPROVEMENT OF.**Appropriations.**

1882..... \$10,000, '83, 465.

Contracts.

R. Hamilton, jr., for dredging, at 24½ cents per cubic yard, '83, 465.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72; '81, 77; '83, 72; '84, 78; '85, 66; '86, 66; '87, 28.

ENGINEERS IN CHARGE.

Col. G. Thom, 1880-'83. Report, '81, 532.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 464; '84, 551; '85, 519.

Lient. Col. G. L. Gillespie, 1886-'—. Reports, '86, 579; '87, 520.

ASSISTANT.

S. Haagsen. Report, '81, 533.

MALDEN RIVER, MASS.—Continued.**Operations.**

1882-'83. 4,420 cubic yards material dredged from channel below Malden River draw-bridge, '83, 464.

1883-'84. 30,811 cubic yards material dredged, '84, 551.

1884-'87. No operations, '85, 519; '86, 580; '87, 520.

Physical Characteristics.

Description of river, '81, 532.

Projects.

By Col. Thom, 1880, to secure a 12-foot navigation in a channel 100 feet wide, from Malden River bridge to junction with Mystic River, together with a cut-off of same depth through the marsh one-half mile above. Estimated cost, \$35,000, '81, 532, 533. The project was modified in 1882 to provide for the excavation of a channel following the natural bed of the river at an estimated cost of \$47,000, '85, 519; '86, 580.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Thom, '81, 532.

MAMARONECK HARBOR, N. Y.—IMPROVEMENT OF.**Appropriations.**

1882..... \$15,000, '83, 525.

Contracts.

1883. J. H. Fenner, for rock removed, at lump price, \$13,000, '83, 525.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 97; '82, 97; '83, 92; '84, 98; '85, 89; '86, 90; '87, 52.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1881-'83. Report, '82, 637.

Lient. Col. W. McFarland, 1883-'86. Reports, '83, 524; '84, 655; '85, 662.

Lient. Col. D. C. Houston, 1886-'— . Reports, '86, 657; '87, 622.

ASSISTANT.

H. N. Babcock. Report, '82, 638.

Operations.

1883-'84. Rock removed under Fenner's contract completed, '84, 655.

1884-'87. No operations, '85, 663; '86, 657; '87, 623.

Projects.

By Maj. Barlow, 1882, for improvement of Mamaroneck Harbor by removal of Round Rock to 4-foot depth, and of Bush Rock, part of Nell's Rock to 4-foot depth, and of Bush Rock, part of Nell's Rock, Inner and Outer Steamboat rocks, and Little Nanhook to 7-foot depth, together with the excavation of a 7-foot channel 100 feet wide to the old steamboat wharf and continuing it, with 4-foot depth and 80-foot width, to new steamboat wharf. Estimated cost, \$43,000, '82, 639, 640; '87, 623.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Maj. Barlow, '82, 637.

MAPS.

'83, 524; '86, 656.

MANASQUAN RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 287.)

Appropriations.

1879..... \$12,000

1880..... 20,000, '80, 548.

1882..... 7,000, '82, 703.

Contracts.

1879. C. F. Drake, for construction of jetties, annulled for failure to commence, '80, 547; '81, 710.

1880. H. Du Bois & Sons, for timber jetty construction, '81, 712.

1882. S. A. Kelly, for timber jetty construction, '83, 585.

MANASQUAN RIVER, N. J.—Continued.**Commerce.**

Uncertainty of condition of harbor entrance an effectual bar to growth of commerce, '81, 711.

Locality considered as a harbor of refuge, '80, 552; '81, 713; '82, 702.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 88; '81, 112; '82, 112; '83, 109; '84, 116; '85, 107; '86, 102; '87, 75.

BOARD OF ENGINEERS.

Convened at New York April 6, 1880, to consider the project of Col. Macomb for improvement of the Manasquan River, '80, 348. (Cols. Macomb, Tower, and Newton and Maj. Abbot.)

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1878-'80. Report, '80, 553.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 547; '81, 710, 712.

Lieut. Col. G. L. Gillespie, 1882-'86. Reports, '82, 701; '83, 583; '84, 751; '85, 756.

Lieut. Col. W. McFarland, 1886. Report, '86, 751.

Lieut. G. McC. Derby, 1887-'—. Report, '87, 782.

Operations.

1881-'82. 1,515 linear feet timber jetty constructed, '82, 702.

1882-'83. 475 linear feet of south jetty built, '83, 584.

1883-'87. No operations, '84, 751; '85, 756; '86, 756; '87, 782.

Projects.

By Col. Macomb, 1879, for constructions of jetties at the inlet to control and to concentrate the scouring action of ebb tides; the improvement of the upper river by dredging and removal of wrecks, logs, and snags. Estimated cost, \$52,120, '72, 68, 462, 464; '86, 751.

The Board of Engineers of 1880 considered that the jetties proposed would be insufficient to maintain the desired improvement, '80, 552; '86, 752. Conclusions of Board justified by subsequent experience, '86, 754.

In 1882 Col. Gillespie proposed the extension of north jetty seaward 255 feet and for construction of 905 linear feet of jetty on south side. Estimated cost, \$40,000, '82, 702; '86, 753.

Surveys.**MAPS.**

'80, 550; '82, 702; '87, 782.

MANATEE RIVER, FLA.—IMPROVEMENT OF.

(See also PEASE RIVER, FLA.)

Appropriations.

1882..... \$12,000, '83, 1028.

1886..... *13,000, '86, 1151; '87, 1241.

1888..... 5,000, act of August 11, 1888.

Contracts.

1883. J. Maguire, for dredging, at 49½ cents per cubic yard, '83, 1029.

1886. R. Moore, for dredging, at 50 cents per cubic yard, '87, 1241.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 186; '83, 197; '84, 205; '85, 197; '86, 195; '87, 159.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1881-'85. Reports, '82, 1319; '83, 1028; '84, 1215.

Capt. W. T. Russell, 1885-'86. Report, '85, 1272.

Capt. W. M. Black, 1886-'—. Reports, '86, 1150; '87, 1239.

ASSISTANT.

P. Robinson. Report, '82, 1320.

Operations.

1882-'83. 2,405 cubic yards material dredged from channel in Tampa Bay, '83, 1028.

1883-'84. 18,864 cubic yards material dredged from cut between Tampa Bay and Shaw's Point, '84, 1216.

1884-'87. No operations, '85, 1272; '86, 1151; '87, 1241.

*Of this amount \$2,000 was for Pease River, '87, 1241.

MANATEE RIVER, FLA.—Continued.**Projects.**

By Maj. Damrell, 1882, for improvement of Manatee River by the excavation of a channel 100 feet wide and 13 feet deep at mean low water, from Tampa Bay to Shaw's and McNeill's Points, a distance of about 4 miles. Estimated cost, \$70,000, '82, 1321; '83, 1028; '86, 1151.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Damrell, '82, 1319.

MANCHESTER HARBOR, MASS.

Examination ordered by act of August 5, 1886, '87, 31. [\$2,500 appropriated by act of August 11, 1888.]

MANISTEE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 288.)

Appropriations.

1867-'79	\$183,000
1880.....	10,000, '80, 2012.
1881.....	10,000, '81, 2206.
1882.....	15,000, '82, 2288.
1884.....	10,000, '84, 1976.
1886.....	10,000, '86, 1760.
Total	238,000
1888.....	10,000, act of August 11, 1888.

Contracts.

1879. H. S. Dale, for pier extension and dredging, the latter at 18½ cents per cubic yard, '80, 2012.
 1881. D. Dewar, for pier construction, '81, 2206. Carlin, Stickney & Cram, for pier construction, '81, 2206.
 1882. Green Bay Dredge and Pile Driver Company, for dredging, at 23 cents per cubic yard, '83, 1814. Dewar & Wing, for pier extension, '83, 1814.
 1884. D. Dewar, for crib construction, '85, 2072.
 1886. D. Drake, for edgings, '86, 1760. S. Belford, for materials, '86, 1760.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 215; '81, 291; '82, 286; '83, 293; '84, 205; '85, 316; '86, 311; '87, 279.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80. Report, '80, 214.
 Maj. F. Harwood, 1880-'82. Reports, '80, 2011; '81, 2205.
 Maj. D. P. Heap, 1882-'83. Report, '82, 2287.
 Capt. D. W. Lockwood, 1883-'— . Reports, '83, 1813; '84, 1976; '85, 2071; '86, 1759; '87, 2182.

Operations.

- 1879-'80. Three cribs framed and dredging in progress, '80, 2011.
 1880-'81. Three cribs sunk and 11,260 cubic yards dredged, '81, 2205.
 1881-'82. Two cribs constructed; 3 cribs in north pier extension leveled; superstructure placed thereon; sand fence built along outer face of south pier at beach line; superstructure to north pier extension completed; 10,019 cubic yards material dredged, '82, 2288.
 1882-'83. Dredging and pier extension continued, '83, 1813.
 1883-'84. South pier extended 50 linear feet and 14,002 cubic yards material dredged, '84, 1976.
 1884-'85. Repairs to piers damaged by collision, '85, 2071.
 1885-'86. South pier extended 50 feet, '86, 1760. Condition of improvement, '86, 1759.
 1886-'87. Portions of north and south pier crib-work renewed, '87, 2183.

MANISTEE HARBOR, MICH.—Continued.**Projects.**

The project of 1866, with the modifications of 1870 and 1874, proposed the parallel extension of crib-piers so as to obtain at least 12 feet depth of channel. Estimated cost, \$180,949, '76, 469. Modified in 1870 and 1874 for extension of piers at a total estimated cost of \$234,000, '80, 2012. In 1886, after an aggregate appropriation of \$248,000, it was estimated that \$92,700 would be required to complete project, '86, 1760.

Surveys.**MAPS.**

'82, 2288; '84, 1976.

MANISTIQUE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 290.)

Appropriations.

1890..... \$5,000, '80, 1902.
1881..... 1,000, '81, 2054.

Contracts.

1881. Chicago Lumbering Company, for dredging, at 15 cents per cubic yard, '81, 2055.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 203, 206; '81, 273; '82, 268; '83, 276; '84, 276; '85, 299; '86, 293; '87, 259.

ENGINEERS IN CHARGE.

Maj. H. M. Robert, 1879-'83. Reports, '80, 1902, 1931; '81, 2054, 2055, 2057; '82, 2117, 2118.

Maj. J. W. Barlow, 1883, '83, 1629.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1637.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1832; '85, 1974.

Capt. W. L. Marshall, 1886, '86, 290.

Capt. C. E. L. B. Davis, 1886-'— . Reports, '86, 1649; '87, 2001.

ASSISTANT.

L. Y. Schermerhorn. Report, '80, 1931.

Operations.

1880-'81. 11,780 cubic yards material dredged, '81, 2054.

1881-'87. Operations abandoned for refusal of interests controlling the harbor to rectify pier lines, '82, 2118; '86, 293; '87, 2001.

Projects.

By Maj. Robert, 1879, for removal of 20,000 cubic yards of sand from between existing piers. Estimated cost, \$6,000; '80, 1932.

(See OPERATIONS.)

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Robert, '80, 1931.

MAPS.

'81, 2054.

MANITOWOC HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 290.)

Appropriations.

1852-'79..... \$240,820
1880..... 7,000, '80, 1918.
1881..... 4,000, '81, 2094.
1882..... 10,000, '82, 2147.
1884..... 15,000, '84, 1854.
1886..... 15,000, '86, 1669.

Total 291,820
1888..... 8,000, act of August 11, 1888.

Commerce.

Benefit derived from improvement, '80, 1919.

MANITOWOC HARBOR, WIS.—Continued.**Contracts.**

1881. Truman & Cooper, for crib construction, '81, 2095.
 1882. Green Bay Dredge and Pile Driver Company, for dredging, at 22 cents per cubic yard, '83, 1689.
 1886. Truman & Cooper, for crib construction, '87, 2045.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 205; '81, 277; '82, 273; '83, 282; '84, 282; '85, 305; '86, 299; '87, 254.

ENGINEERS IN CHARGE.

Maj. H. M. Robert, 1875-'83. Reports, '80, 1917; '81, 2094; '82, 2146.
 Maj. J. W. Barlow, 1883. '83, 1629.
 Capt. F. A. Hinman, 1883-'84. Report, '83, 1688.
 Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1853; '85, 1998.
 Capt. W. L. Marshall, 1886. '86, 290.
 Capt. C. E. L. B. Davis, 1886-'—. Reports, '86, 1667; '87, 2044.

ASSISTANT.

L. Y. Schermerhorn. Report, '81, 2096.

Operations.

- 1879-'80. Superstructure over 6 cribs built and half filled with stone; repairs to piers, '80, 1917.
 1880-'81. Four cribs built and placed in extension of piers; repairs to piers, '81, 2094.
 1881-'82. Superstructure built over four cribs; filling completed; 8,949 cubic yards of material dredged by city of Manitowoc, '82, 2146.
 1882-'83. 33,492 cubic yards material dredged from between piers, '83, 1688.
 1883-'84. No operations, '84, 1854.
 1884-'85. Five cribs sunk in extension of north pier and superstructure built thereon, '85, 1998.
 1885-'86. Repairs to north pier, '86, 1668.
 1886-'87. Four cribs sunk in extension of south pier, '87, 2045.

Projects.

The original project of 1866, together with the modifications of 1869, 1872, and 1881, proposed the formation of a channel between two parallel crib-piers 250 feet apart, between the 184-foot curve in the lake and deep water in the river, 14 feet deep at the inner end, increasing to 18 feet at the outer end. Estimated cost, \$308,182.54; '81, 2094; '86, 1667; '87, 2044.

MANOKIN RIVER, MD.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 151.

ENGINEER IN CHARGE.

Capt. T. Turtle. Report, '84, 951.

Physical Characteristics.

Description of river, '84, 951.

Plans.

In 1882 the river was not recommended for improvement, '84, 151, 952.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Turtle, '84, 951.

MANTUA CREEK, N. J.—IMPROVEMENT OF.**Appropriations.**

1882..... \$3,000, '83, 641.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 126; '83, 126; '84, 134; '85, 123; '86, 121; '87, 83.

ENGINEERS IN CHARGE.

Capt. W. Ludlow, 1881-'83. Report, '82, 806.
 Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 640.
 Maj. W. H. Heuer, 1884-'85. Report, '84, 837.
 Lieut. Col. H. M. Robert, 1885-'—. Reports, '85, 850; '86, 844; '87, 809.

MANTUA CREEK, N. J.—Continued.**Engineers—Continued.****ASSISTANTS.**

E. A. Giessler. Report, '82, 807.

A. Stierle. Report, '84, 837.

Operations.

Application of appropriation of 1882 withheld by order of Secretary of War until further appropriations should be made, '87, 809.

Projects.

By Capt. Ludlow, 1882, for improvement of Mantua Creek between Mantua and the mouth by excavation of a channel having a low-water depth of 10 feet and a width of 80 feet at the mouth, diminishing to 4 feet depth and 40 feet width at Mantua. Estimated cost, \$35,000, '82, 806.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Ludlow, '82, 806.

MAQUAM BAY, VT. (See SWANTON HARBOR, VT.)**MARCUS HOOK, PA.—ICE-HARBOR AT.**

(Continued from Vol. I, p. 293.)

Appropriations.

1829-'79	\$104,000
1880	35,000, '80, 543.
1881	30,000, '81, 766.
1882	15,000, '82, 751.
1886	15,000, '86, 833.

Total	199,000
1888	15,000, act of August 11, 1888.

Contracts.

1880. Mount Waldo Granite Company, for construction of 2 piers, '81, 767.

1882. Leiper & Lewis, for pier construction, '83, 617.

1884. Leiper & Lewis, for pier construction, '84, 814.

1885. American Dredging Company, for dredging, at 20 cents per cubic yard, '86, 832. Davis, Irvin & Sanville, for driving mooring piles, '86, 833.

1887. Ira Lunt, for the construction of an ice-pier, '87, 803.

Encroachments.

Improper use of piers by vessel owners, '87, 802.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 93; '81, 120; '82, 120; '83, 118; '84, 128; '85, 120; '86, 117; '87, 79.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 583; '81, 764.

Capt. W. Ludlow, 1882-'83. Report, '82, 750.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 616.

Maj. W. H. Heuer, 1884-'85. Report, '84, 814.

Lieut. Col. H. M. Robert, 1885-'—, Reports, '85, 839; '86, 832; '87, 802.

Operations.

1880-'81. Seven clusters of mooring piles driven along inner line of harbor, '81, 765.

1881-'82. Repairs to landing piers, '82, 750.

1882-'83. Crib superstructure for Pier No. 7 sunk, '83, 616.

1883-'84. Pier No. 7 completed and reconstruction of Pier No. 5 commenced, '84, 814.

1884-'85. Pier No. 5 reconstructed, '85, 839.

1885-'86. 34,000 cubic yards material dredged and two groups of mooring piles placed, '86, 832, 833.

1886-'87. Construction of crib substructure for Pier No. 6, '87, 802.

MARCUS HOOK, PA.—Continued.**Projects.**

The original project of 1866, with the amendments thereto, proposes the formation of a harbor for the protection of vessels against moving ice by the construction of stone piers behind which vessels can anchor, and the formation of a bulkhead about 1,800 feet long parallel with the shore-line and about 150 feet outside of high water-line, together with the deepening, by dredging, of the area behind the piers and in front of the bulkhead, '86, 117. Total amount appropriated from 1829 to 1886, inclusive, \$199,000; amount required to complete project, \$3,000, '86, 833.

MARQUETTE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 294.)

Appropriations.

1867-'73	\$297,230
1880	1,000, '80, 1901.
1882	16,000, '82, 2116.
1884	5,000, '84, 1829.
1886	1,000, '86, 448.

Total	329,230
1888	25,000, act of August 11, 1888.

Encroachments.

Upon harbor area by dock owners, '87, 1996.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 202; '81, 272; '82, 267; '83, 275; '84, 274; '85, 297; '86, 291; '87, 257.

ENGINEERS IN CHARGE.

Maj. H. M. Robert, 1875-'83. Reports, '80, 1900; '82, 2037; '82, 2115.

Maj. J. W. Barlow, 1883. '83, 1629.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1633.

Lient. Col. J. W. Barlow, 1884-'86. Reports, '84, 1829; '85, 1971.

Capt. W. L. Marshall, 1886. '86, 290.

Capt. C. E. L. B. Davis, 1886-'—. Reports, '86, 1645; '87, 1995.

Operations.

1879-'80. Repairs to breakwater, '80, 1900.

1880-'81. Repairs to breakwater, '81, 3037.

1881-'82. Extensive repairs to breakwater, '82, 2116.

1882-'83. 1,050 linear feet of breakwater repaired and renewed, '83, 1634.

1883-'84. Repairs to breakwater, '84, 1829.

1884-'86. No operations, '85, 1972; '86, 1645.

1886-'87. 200 feet of breakwater ripped up; 315 feet of superstructure rebuilt; damage to breakwater and pier-head light repaired, '87, 1995.

Projects.

By Maj. W. F. Reynolds, 1866, for a crib breakwater filled with stone, extending from north side of harbor southerly for a distance of 2,000 linear feet, with a width of 20 feet at inner end, increasing to 30 feet at outer end, when completed to be 5 feet above water, '66, iv, 79, 80, 82; '86, 291. Estimated cost, \$385,129, '66, iii, 8, iv 81. In 1875 the breakwater was completed to a length of 2,010 feet, at a cost of \$92,000 less than original estimate, '76, ii, 330; '86, 291.

Maj. Robert then proposed an additional extension of 400 linear feet, at an additional cost of \$68,000, '75, i, 189; '86, 282.

Surveys.**MAPS.**

'87, 1998.

MATAGORDA BAY, TEX.—IMPROVEMENT OF ENTRANCE TO.

(Continued from Vol. I, p. 255.)

Appropriations.

1876-'77	\$70,000.
1880.....	50,000, '80, 1245.
1881.....	60,000, '81, 1358.
1882.....	60,000, '83, 1090.
1884.....	50,000, '84, 1312.
1886.....	37,500, '86, 1330.

Total 327,500

Contracts.

1880. R. Kanters & Son, for jetty construction, '81, 1356.
 1881. G. L. Long, for jetty construction, '82, 1463.
 1882. A. M. Shannon & Co., for jetty construction, '83, 1089
 1884. A. M. Shannon, for jetty construction, '85, 1463.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 148; '81, 202, 204; '82, 199, 201; '83, 204; '84, 219; '85, 228; '86, 225; '87, 191.

BOARD OF ENGINEERS.

Constituted by S. O. No. 63, C. of E., 1879, to report upon improvement of Pass Cavallo Inlet into Matagorda Bay. Report, '80, 1256-1260. (Cols. Tower and Newton and Lieut. Col. Gillmore.)

ENGINEERS IN CHARGE.

Capt. C. W. Howell, 1880. '80, 146.

Maj. S. M. Mansfield, 1880-'86. Reports, '80, 1244, 1256; '81, 1356; '82, 1463, 1493; '83, 1089; '84, 1310; '85, 1462; '86, 1328.

Maj. O. H. Ernst, 1886-'—. Report, '87, 1429.

ASSISTANTS.

J. M. Picton. Report, '82, 1494.

H. C. Ripley. Report, '82, 1465.

Operations.

1880-'81. Partial construction of 958 linear feet of jetty on south side of channel, '81, 1357.

1881-'82. Work in progress over 1,325 linear feet of jetty, '82, 1463, 1466.

1882-'83. Foundation course extended seaward 2,150 feet, '83, 1089.

1883-'84. Foundation course extended 1,723 feet seaward, making a total extension of 5,253 linear feet, '84, 1311.

1884-'85. 7,158 cubic yards of mattress and 1,861 tons of stone placed in the jetty to increase its height, '85, 1463.

1885-'86. 4,027 cubic yards of mattress and 1,131 tons of stone placed in the work, '86, 1329.

1886-'87. No operations, '87, 1429.

Physical Characteristics.

Description of locality, '80, 1257.

Plans.

By Capt. Howell, 1874, for the construction of gabionades to close Elizabeth and Decrow channels to confine current to main channel, and by the resulting scour to deepen it. Estimated cost, \$715,325, '74, i, 763, 764; '77, 469; '80, 1244, 1258.

By Maj. Mansfield, 1881, for the formation, by dredging, of a channel 100 feet wide and 3 feet deep across the bar in Matagorda Bay in front of inlet to Saint Mary's Bayou. Estimated cost, \$10,000, '82, 1494.

Projects.

The Board of Engineers of 1879, recommended the extension of a jetty from the head of Matagorda Island in a southeastern direction, and the construction of groins and transverse jetties for shore protection, the object being to obtain a 12-foot channel across the bar and protect the head of Matagorda Island. Estimated cost, \$1,039,280, '80, 1258-1260; '86, 1329; '87, 1430.

Surveys.

Near mouth of Saint Mary's Bayou, ordered by act of March 3, 1879, '81, 203. Made under direction of Maj. Mansfield, 1881, '82, 1493.

Comparison of surveys, '82, 1467.

MAPS

Of Cavallo Pass, '80, 1258; '85, 1462.

MATINICUS ISLE, ME., with view to a harbor of refuge at—
EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 21.

ENGINEER IN CHARGE.

Maj. J. A. Smith, 1887. Report, '87, 475.

Physical Characteristics.

Description, '87, 476.

Plans.

Maj. Smith, 1887, reports that the general commerce of the country would not be benefited by an improvement at Matinicus, and therefore does not recommend the same, '87, 477.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Smith, '87, 475.

MATTAPONI RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 296.)

Appropriations.

1880.....	\$2,500, '80, 773.
1881.....	3,300, '81, 969.
1884.....	2,500, '84, 992.
1886.....	5,000, '86, 916.

Total.....	13,300
------------	--------

1888..... 3,000, act of August 11, 1888.

Statement of appropriations, '87, 941.

Contracts.

1887. D. A. Gillies, for dike construction, '87, 941.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 114; '81, 155; '82, 150; '83, 156; '84, 158; '85, 148; '86, 143; '87, 109.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1875—'. Reports, '80, 770; '81, 968; '82, 1033; '83, 817; '84, 991; '85, 979; '86, 915; '87, 940.

Operations.

1880-'81. Derrick, derrick-boat, quarter-boat, and scows constructed, '81, 969.

1881-'82. 2,016 snags, 1,378 logs and trees, and 4 wrecks removed, cleaning 13 miles of river, '82, 1034.

1882-'83. 94 snags, 279 logs and trees, and 1 wreck removed, '83, 818.

1883-'86. No operations, '84, 991; '85, 979; '86, 916.

1886-'87. 242 linear feet of dike built, '77, 941.

Physical Characteristics.

Description of river and its obstructions, '80, 771.

Projects.

By S. T. Abert, 1875, for removal of snags and wrecks and excavation of channel from head of navigation to Line Tree Bar, having a width of 40 feet and a depth of 5½ feet at low water. Estimated cost, \$34,059, '75, ii, 169, 170.

In 1884 S. T. Abert proposed, in addition to the previous project, the construction of dikes at Robinson and Latane's bars, at an estimated cost of \$38,000, '85, 979, 980; '86, 143, 916; '87, 941.

Surveys.

MAPS.

'85, 980; '87, 941.

MATTAWAN CREEK, N. J.—IMPROVEMENT OF.**Appropriations.**

1881.....	\$15,000, '81, 720.
1882.....	6,000, '82, 707.

Contracts.

1881. J. Van Patton, for dredging, at 48 cents per cubic yard, '81, 720.

1882. F. Pidgeon, jr., for dredging, at 59 cents per cubic yard, '83, 588.

MATTAWAN CREEK, N. J.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 90; '81, 113, 115; '82, 113; '83, 110; '84, 119; '85, 111; '86, 105; '87, 74.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'81. Report, '81, 720.

Col. J. Newton, 1881. Report, '82, 683.

Lieut. Col. G. L. Gillespie, 1881-'85. Reports, '82, 706; '83, 587; '84, 756; '85, 763.

Lieut. Col. W. McFarland, 1885. Report, '86, 761.

Lieut. G. McC. Derby, 1887-'—. Report, '87, 777.

ASSISTANT.

A. Doerflinger. Report, '81, 721.

Operations.

1881-'82. 25,630 cubic yards material removed by dredging, '72, 706.

1882-'83. 8,897 cubic yards material dredged, '83, 587.

1883-'87. No operations for lack of funds, '84, 757; '85, 763; '86, 762; '87, 777.

Projects.

By Lieut. Col. Michler, 1880, for formation of a channel, by dredging, 4 feet deep at mean low water and 100 feet wide, from the mouth up to Winkson Creek, a distance of about 1½ miles, thence for about 2 miles to head of navigation at the Long Branch Railroad Bridge 4 feet deep at mean low water and 75 feet wide. Estimated cost, \$33,120, '81, 722; '86, 762.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Michler, '81, 720.

MATTOX CREEK, VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 114.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1886. Report, '87, 959.

Physical Characteristics.

Description, '87, 959.

Plans.

S. T. Abert, 1886, reports that the creek has sufficient depth of water for present commercial purposes, and does not recommend further improvement, '87, 960.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of S. T. Abert, '87, 956.

MAUMEE BAY, OHIO. (See TOLEDO HARBOR.)**MAUMEE RIVER, OHIO—SURVEY OF, FROM PERRYSBURGH TO TOLEDO.**

(Continued from Vol. I, p. 297.)

Appropriations.

1872-'79 \$7,000.

Engineers.**CHIEF OF ENGINEERS.**

Report, '81, 314.

ENGINEER IN CHARGE.

Maj. J. M. Wilson. Report, '81, 2341.

Physical Characteristics.

Description of river, '81, 2341.

MAUMEE RIVER, OHIO—Continued.**Plans.**

By Maj. Wilson, 1880, for the formation of a channel 100 feet wide and 8 feet deep at low water from Perrysburgh to Toledo, by dredging, rock removal, and dike construction. Estimated cost, \$124,748, '81, 2342.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Wilson, 1880, '81, 2341.

MAURICE RIVER, N. J.—IMPROVEMENT OF.**Appropriations.**

1882..... \$3,000, '83, 639.
 1884..... 17,000, '84, 836.
 1886..... 5,000, '86, 856.
 1888..... 10,000, act of August 11, 1888.

Commerce.

Commercial statistics, '83, 640.

Contracts.

1885. American Dredging Company, for dredging, at 15 cents per cubic yard, '85, 868.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 126; '83, 125; '84, 134; '85, 127; '86, 124; '87, 86.

ENGINEERS IN CHARGE.

Capt. W. Ludlow, 1882-'83. Report, '82, 809.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 639.

Maj. W. H. Heuer, 1884-'85. Report, '84, 836.

W. F. Smith, U. S. Agent, 1885—. Reports, '85, 868; '86, 855; '87, 826.

ASSISTANTS.

E. A. Gieseler. Report, '82, 812.

J. J. Lee. Report, '83, 639.

A. Stierle. Report, '84, 837.

Operations.

1885-'86. 110,015 cubic yards material dredged from various points in the channel between Millville and the mouth, '86, 856.

1886-'87. No operations, '87, 826.

Physical Characteristics.

Description of river, '82, 812.

Projects.

By Capt. Ludlow, 1882, for improvement of Maurice River between Millville and its mouth, by excavation of a channel 100 feet wide and 4 feet deep at mean low water, commencing $2\frac{1}{2}$ miles below the bridge at Millville to a point called Pea Landing; also a cut of same width and depth through a point of land at Silver River. From Pea Landing to the bridge the channel to be 4 feet deep and 50 feet wide; for a distance of 400 feet above the bridge the 100-foot width to be resumed, being reduced to 50 feet for the next 500-foot length. Estimated cost, \$114,500, '82, 811; '85, 868; '87, 86.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Col. Maccomb, '82, 809.

MEADOW RIVER, W. VA.

Examination ordered by act of August 5, 1886, '87, 253.

MEEKER'S ISLAND LOCK AND DAM. (See MISSISSIPPI RIVER, MECKER'S ISLAND LOCK AND DAM.)

NEHERBIN RIVER, N. C.—IMPROVEMENT OF.**Appropriations.**

1882..... \$5,000, '83, 846.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 168; '82, 163; '83, 163; '84, 166; '85, 160; '86, 155; '87, 121.

ENGINEERS IN CHARGE.

Capt. J. Mercur, 1881-'84. Reports, '82, 1114; '83, 846.

Capt. F. A. Hinman, 1884-'--. Reports, '84, 1034; '85, 1041; '86, 965; '87, 989.

ASSISTANT.

C. M. Yeates. Report, '82, 1115.

Operations.

1882-'83. Removal of obstructions commenced, '83, 846.

1883-'84. 1,002 trees, logs, snags, and piles, and 296 overhanging trees removed from the river between mouth and Murfreesborough, '84, 1034.

1884-'85. 119 snags, logs, and trees removed, '85, 1041.

1885-'87. No operations, '86, 965; '87, 989.

Projects.

By Capt. Mercur, 1882, for removal of snags, logs, and similar obstructions to secure a 9-foot channel 80 feet in width from the mouth to Murfreesborough. Estimated cost, \$125,000, '82, 1115.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Mercur, '82, 1114.

MEMPHIS, TENN. (See MISSISSIPPI RIVER BETWEEN THE MOUTH OF THE OHIO AND HEAD OF THE PASSES.)**MENDOCINO BAY, CAL.—EXAMINATION OF.**

(See HARBOR OF REFUGE ON PACIFIC COAST.)

MENEMSHA HARBOR, MASS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 43.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Elliot, 1886. Report, '87, 569.

Physical Characteristics.

Description of harbor, '87, 570.

Plans.

Lieut. Col. Elliot reports, 1886, that the prospective benefit to commerce does not justify any improvement at this locality, '87, 571.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Elliot, '87, 569.

MENOMONEE HARBOR, MICH. AND WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 298.)

Appropriations.

1871-'79 \$153,000
 1880 10,000, '80, 1903.
 1881 12,000, '81, 2059.

MENOMONEE HARBOR, MICH. AND WIS.—Continued.**Appropriations—Continued.**

1882.....	\$15,000, '82, 2127.
1884.....	10,000, '84, 1837.
1886.....	3,000, '86, 1653.

Total.....	203,000
1888.....	9,000, act of August 11, 1883.

Contracts.

1880. Green Bay Dredge and Pile Driver Company, for pier extension, '80, 1904.
 Truman & Cooper, for pier extension, '81, 2060.
 1881. Green Bay Dredge and Pile Driver Company, for pier extension, '81, 2060.
 1882. S. M. Stephenson, for dredging, at 10 cents per cubic yard, '83, 1640. Truman & Cooper, for pier extension, substructure and superstructure construction, '83, 1641.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 203; '81, 273; '82, 269; '83, 277; '84, 277; '85, 299; '86, 294; '87, 260.

ENGINEERS IN CHARGE.

Maj. H. M. Robert, 1875-'83. Reports, '80, 1903; '81, 2068; '82, 2125.
 Maj. J. W. Barlow, 1883. '83, 1629.
 Capt. F. A. Hinman, 1883. Report, '83, 1640.
 Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1835; '85, 1978.
 Capt. W. L. Marshall. 1886, '86, 290.
 Capt. C. E. L. B. Davis, 1886-'— Reports, '86, 1652; '87, 2004.

ASSISTANT.

C. Croesman. Report, '84, 1837.

Operations.

- 1879-'80. Six cribs sunk in extension of the north pier and superstructure built over 3 cribs previously sunk, '80, 1903.
 1880-'81. Four cribs placed in extension of south pier, partial superstructure built over six cribs on north pier, and 2,500 cubic yards material dredged from channel, '81, 2059.
 1881-'82. Six crib substructures placed in extension of south pier; superstructure built over four cribs, '82, 2125.
 1882-'83. 3,950 cubic yards material dredged from channel, '83, 1640.
 1883-'84. South pier extended 200 linear feet and partial superstructure built over 300 feet of same; north pier extended 50 linear feet and outer crib replaced, '84, 1835.
 1884-'85. Superstructure completed over 350 feet of north pier and over 700 feet of south pier, '85, 1978.
 1885-'86. No operations, '86, 1652.
 1886-'87. 37,895 cubic yards material dredged, '87, 2005.

Plans.

In 1884 Lieut. Col. Barlow proposed the extension of the piers to the 18-foot curve in the lake, dredging between the piers, and extensive repairs to existing superstructure, increasing the estimated cost to \$300,000, '84, 1835, 1836.

Private and Corporate Work.

Improper use of piers by lumber companies, '84, 1836, 1837; '85, 300, 1879, 1880; '86, 1652.

Projects.

By Maj. Houston, 1871-'74, for the extension of two parallel piers about 400 feet apart to the 16-foot curve in bay, with dredging between the piers to afford a channel between the entrance and deep water in the river 14 feet deep. Estimated cost, \$212,000, '71, 109; '72, 115; '74, 139; '84, 1835; '86, 1652.

Survey.

Of harbor and vicinity, 1881, '81, 2059.

MAPS.

'81, 2060.

MERAMAC RIVER, MO.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 161; '81, 223.

ENGINEER IN CHARGE.

Capt. O. H. Ernst. Report, '81, 1596.

MERAMAC RIVER, MO.—Continued.**Plans.**

Capt. Ernst considers—

- (1) That the Meramac is not now a navigable river.
- (2) That it is not capable of such improvement as will adapt it to the commerce of the surrounding country, '81, 1597.

Surveys.

Ordered by act of June 14, 1890. Made, 1890, under direction of Capt. Ernst, '81, 1596.

MERRIMAC RIVER, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 300.)

Appropriations.

1828-79	\$197,366.72
1880	12,000.00, '80, 345.
1881	9,000.00, '81, 514.
1882	9,000.00, '82, 512.
1884	3,500.00, '84, 501.

Total 230,866.72

Between 1828 and 1834, inclusive, \$60,366.72 was appropriated for the removal of a sand-bar and construction of a breakwater at the mouth of the river.

List of appropriations from 1870 to 1886, '86, 561.

Contracts.

1880. J. Andrews, for removal of Gangway Rock, at \$30 per cubic yard, '81, 515.
 1881. G. W. Townsend, for removal of Gangway Rock, at \$27.50 per cubic yard, '81, 515. Trumbull & Cheney, for removal of rock, at \$44 per cubic yard, '81, 575. Contract abandoned after partial completion, '83, 440.
 1882. Hamilton & Floyd, for removal of South Badger Ledge, at \$110 per cubic yard, '83, 441. G. W. Townsend, for removal of North Rocks, at \$35 per cubic yard, '83, 441.
 1884. J. McDermott, for dredging, at Rock's Bridge, at \$2.18 per cubic yard, '85, 500.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 68; '81, 72, 77; '82, 72, 77; '83, 67; '84, 74; '85, 61; '86, 61; '87, 23.

ENGINEERS IN CHARGE.

Col. G. Thom, 1871-'83. Reports, '80, 343; '81, 511; '82, 510, 532.
 Maj. C. W. Raymond, 1883-'86. Reports, '83, 439; '84, 500; '85, 499.
 Lieut. Col. G. L. Gillespie, 1886-'— . Reports, '86, 560; '87, 493.

ASSISTANT.

S. Haagenzen. Report, '82, 535-544; '83, 441.

Operations.

- 1879-'80. Improvement of channel at and below the upper and lower falls, '80, 344.
 1880-'81. 124½ cubic yards rock removed from Gangway Rock, North Rocks, and from channel at Lower Falls; also removal of sunken piers and wrecks from Newburyport Harbor and deepening the channel by dredging at the Lower Falls Rock's Bridge, '81, 512.
 1881-'82. Completion of the removal of South Gangway Rock to 9 feet depth and of South Badger Ledge and North Spur Rocks in part to depth of 10 feet, '82, 511.
 1882-'83. Breaking up and removal of South Badger Ledge and partial removal of North Rock, '83, 440.
 1883-'84. Removal of North Rock to a depth of 9 feet, '84, 500.
 1884-'85. 1,056 cubic yards bowlders, gravel, and clay removed by dredging from channel at Rock's Bridge, '85, 500.
 1885-'87. No operations for lack of funds, '86, 561; '87, 494.

Physical Characteristics.

Description of river from Lawrence to Manchester, '82, 532.

Plans.

By Col. Thom, 1881, for an improved channel from the head of Mitchell's Falls at Lawrence, 21½ miles above the mouth of the river, to Manchester, N. H., a distance of 70 miles above the mouth, by rock removal and dredging, with locks and canal walls on the section of river between Nashua and Manchester, N. H. Estimated cost, \$548,000, exclusive of the cost of new canals and locks at Lawrence and Lowell or the cost of adapting the present ones to the purposes of navigation, '82, 533, 534, 539, 541.

MERRIMAC RIVER, MASS.—Continued.**Projects.**

Between 1828 and 1834, inclusive, \$60,366.72 were appropriated for the removal of a sand-bar and the construction of a breakwater at the mouth of the river.

The original project, 1869, proposed the removal of obstructions from the upper and lower falls of Gangway Rock, the Boilers, and a wreck near the mouth. Estimated cost, \$69,025, '69, 421; '70, 469-473; '76, i, 165; '86, 61.

In 1874 the project was extended to include the removal of rocks at Deer Island and at Rock's Bridge and Little Carrier Shoal, so as to give channel depths at ordinary high water as follows: From mouth to Deer Island Bridge, 16½ feet; thence to Haverhill Bridge, 12 feet; thence to foot of Mitchell's Falls, 10 feet; thence to head of Upper Falls, 4½ feet. Estimated cost, including project of 1869, \$147,000, '76, i, 166; '86, 61; '87, 494.

Project completed in 1884 under an aggregate appropriation of \$167,000, when it was estimated that \$26,000 additional would be required for the further improvement of the river between Plumb Island Light and Lawrence, '82, 534, 541; '84, 501; '86, 561; '87, 494.

Surveys.

From Lawrence to Manchester ordered by act of March 3, 1881, '81, 77. Made under direction of Col. Thom, 1-81, '81, 532. At Rock's Bridge, made, 1883, '83, 441.

MICHIGAN CITY HARBOR, IND.—IMPROVEMENT OF.

(Continued from Vol. I, p. 302.)

Appropriations.**OUTER HARBOR:**

1836-'79	\$679,888.92
1880	40,000.00, '80, 2005.
1881	20,000.00, '81, 2185.
1882	60,000.00, '83, 1801.
1884	40,000.00, '85, 2089.
1886	54,375.00, '86, 1775.

Total 894,263.92

1888 90,000.00, act of August 11, 1888.

INNER HARBOR:

1880	\$15,000.00, '80, 2006.
1881	25,000.00, '81, 2195.
1882	20,000.00, '83, 1802.
1884	10,000.00, '85, 2090.
1886	1,875.00, '86, 1776.

Total 71,875.00

1888 5,000.00, act of August 11, 1888.

Total of outer and inner harbor, \$966,138.92.

Commerce.

Vessels wrecked at or near Michigan City, '82, 2269.

Increase in commercial receipts, '82, 2272.

Contracts.

1879. A. S. Packard, for timber, '80, 2005.

1881. N. Culbert, for dredging, at 18 cents per cubic yard, '81, 2193.

1883. A. H. Petrie & Co., for timber, '83, 1799. Haskell & Barker Car Company, for iron, '83, 1799.

1886. J. M. Allmendinger, for oak timber; A. H. Petrie, for pier timber and plank; S. D. Kimbark, for iron; Leathern & Smith, for piles; and Chicago and Leont Stone Company, for stone, '87, 2205.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 212; '81, 287; '82, 282, 2262, 2270; '83, 290; '84, 292; '85, 322; '87, 284.

BOARD OF ENGINEERS.

Convened at Michigan City July 6, 1880, by S. O. No. 83, C. of E., to report upon improvement of Michigan City Harbor. Report, '81, 2187. (Majs. Houston, Robert, Smith, and Lydecker.)

MICHIGAN CITY HARBOR, IND.—Continued.**Engineers—Continued.****BOARD OF ENGINEERS—Continued.**

Convened at Milwaukee, Wis., May 22, 1882, by S. O. No. 19, C. of E., to report upon projects by Maj. Smith, for breakwater and completion of outer harbor. Report, '82, 2264. (Majs. Houston, Robert, Smith, and Lydecker.)

ENGINEERS IN CHARGE.

Maj. J. A. Smith, 1878-'85. Reports, '80, 2003; '81, 2183, 2166, 2190; '82, 2257, 2260, 2263, 2267; '83, 1797; '84, 1965.

Capt. D. W. Lockwood, 1885-'—. Reports, '85, 2088; '86, 1774; '87, 2202.

Operations.

1879-'80. Outer harbor: Six cribs sunk in extension of breakwater and 300 linear feet of superstructure built; also repairs to piers, '80, 2003. Inner harbor: 77,987 cubic yards material dredged, '80, 2006.

1880-'81. Outer harbor: Breakwater extended 160 feet on pile foundation; 5,924 cubic yards material dredged, '81, 2183. Inner harbor: 58,224 cubic yards material dredged by city, '81, 2193.

1881-'82. Outer harbor: Breakwater extended 200 linear feet; extensive repairs to piers; stone scows built and cribs framed, '82, 2257, 2258, 2259. Inner harbor: 62,189 cubic yards material dredged, '82, 2270.

1882-'83. Outer harbor: 150 linear feet crib-work built; 6,504 cubic yards material dredged; repairs to plant, breakwater, and pier, '83, 1798. Inner harbor: 111,580 cubic yards material dredged, '83, 1802.

1883-'84. Outer harbor: 100 linear feet crib-work with superstructure added to east breakwater; piers and breakwater repaired, '84, 1965, 1966. Inner harbor: 116,465 cubic yards material dredged, '84, 1969.

1884-'85. Outer harbor: End wall of west harbor pier rebuilt; one crib sunk in extension of new breakwater pier; 18,370 cubic yards material dredged, '85, 2068. Inner harbor: 21,890 cubic yards material dredged, '85, 2069.

1885-'86. Outer harbor: 50 linear feet crib-work, with superstructure placed in extension of breakwater pier; break in south wall repaired; two new courses of superstructure added to west pier; extensive repairs to plant, '86, 1774. Inner harbor: 27,205 cubic yards material dredged, '86, 1776.

1886-'87. Repairs to west pier, '87, 2202.

Plans.

By Maj. Smith, 1882, for a modification in the construction of the remaining 166 inner feet of the eastern end of the breakwater and also the construction of an outer breakwater northwest of the existing harbor entrance, '82, 2260-2264.

(See also PROJECTS.)

Projects.

Work at this harbor was commenced by the United States in 1836. Between this date and 1852 \$156,203.92 were appropriated, including relief claims, and applied to dredging, crib construction at the entrance to the harbor, and the commencement of a breakwater covering the entrance, '67, 98; '76, ii, 447; S. Doc. 42, 35th Cong., 1st sess., pages 74, 175.

In 1866 previous constructions had practically disappeared by decay and destruction, when the work was resumed under an appropriation of \$75,000, with the proviso that it was to be available when \$100,000 had been expended by the Michigan City Harbor Company, '67, 23, 96, 100. Between 1866 and 1870 the project proposed the formation of a channel of entrance 12 feet deep, to be obtained by pier extension and dredging, '67, 96, 97; '68, 32, 112-117; '69, 28; '70, 97.

Between 1866 and 1869, inclusive, \$131,185 was appropriated. In 1870 the project was adopted for deepening, by dredging, the inner harbor to the railroad bridge, '70, 97.

In 1870 a Board of Engineers recommended the construction of an outer harbor and the deepening, by dredging, of the basin to a uniform depth of 14 feet, at an estimated cost of \$324,421.40, '70, 125; '76, ii, 449; '77, 898; '78, 1188; '79, 1592; '80, 2006. Between 1870 and 1879, inclusive, \$332,500 was appropriated.

In 1879 the project of 1870 for deepening the inner harbor was modified so as to extend it further up Trail Creek, for a width of 120 feet and depth of 15 feet, '79, 1593.

In 1880 a Board of Engineers recommended the extension of a pier 400 feet long from the west end of the breakwater, at right angles thereto, and a second pier 300 feet long and 300 feet to the west, the west extension to be connected with the outer end of the existing west pier by fender piling; also the removal of the old east (river) pier to a point 1,100 feet south of the inner face of the breakwater, and the extension of the breakwater eastward to close the opening proposed at the northeast angle of the harbor in 1877, '81, 2188; '82, 2263.

MICHIGAN CITY HARBOR, IND.—Continued.**Projects—Continued.**

The Board of Engineers of 1882 approved of Maj. Smith's plan for a masonry and concrete superstructure on the remaining east 166 inner feet to be built in completion of the breakwater; also the plan for an exterior breakwater 2,000 feet in length and covering the entrance to the harbor from northerly and north-easterly gales, with the ultimate removal of about 500 feet of the existing west pier at harbor entrance, '82, 2264, 2266, 2270.

Between 1880 and 1886, inclusive, \$224,375 was appropriated for the outer and \$71,875 for the inner harbor, when it was estimated that \$395,625 would be required for the completion of the former and \$3,125 for the latter, '86, 317.

Surveys.**MAPS.**

'80, 2006; '81, 2188; '82, 2270.

MIDDLE FORK, KY.—(See KENTUCKY RIVER.**MIDDLEPORT, OHIO—SURVEY FOR ICE-HARBOR AT.****Commerce.**

Benefit to commerce from ice-harbors, '84, 1708.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 283.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '84, 1707, 1708.

ASSISTANT.

E. J. Carpenter. Report, '84, 1709.

Plans.

By Col. Merrill, for four ice-breakers at Middleport, at an estimated cost of \$9,500; but it is considered that the exact location of ice-harbors should be left to the discretion of the Chief of Engineers, '84, 1708, 1710.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Col. Merrill, '84, 1708

MILFORD HARBOR, CONN.—IMPROVEMENT OF

(Continued from Vol. I, p. 304.)

Appropriations.

1874-'79 \$28,000
 1880 5,000, '80, 458.
 1882 5,000, '82, 615.
 1883 5,000, act of August 11, 1888.
 List of appropriations, 1872-'86, '86, 641; '87, 605.

Contracts.

1880. J. M. Seward, for dredging, at 17 cents per cubic yard, '81, 600.
 1882. H. J. Lewis, for dredging, at 14½ cents per cubic yard, '83, 518; '84, 649.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 78; '81, 92; '82, 93, 97; '83, 89; '84, 95; '85, 84; '86, 85; '87, 48.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1874-'83. Reports, '80, 457; '81, 598; '82, 614, 632.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 517; '84, 648; '85, 648.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 640; '87, 604.

ASSISTANTS.

W. A. Peck. Report, '81, 600.

H. N. Babcock. Report, '82, 633.

MILFORD HARBOR, CONN.—Continued.**Operations.**

- 1879-'80. 47,156 cubic yards dredged from channel above and below the long jetty ; 256 linear feet of jetty built at Burnes's Point, '80, 457.
 1880-'81. 27,068 cubic yards dredged from vicinity of Town and Merwin wharves, '81, 598.
 1881-'82. Survey for breakwater off Welch's Point, '82, 614, 632. Original project completed, '84, 96 ; '86, 641.
 1882-'83. 19,819 cubic yards dredged from channel below Merwin's Wharf, '83, 517.
 1883-'84. 20,049 cubic yards dredged from channel below Merwin's Wharf, '84, 648.
 1884-'87. No operations for lack of funds, '85, 648 ; '86, 641 ; '87, 603.

Plans.

- By Maj. Barlow, 1882, for the protection of local commerce by the construction of a breakwater from Welch's Point. Estimated cost, \$57,000, '82, 614, 632-634 ; '85, 648.

Projects.

- By Maj. Warren, 1872, for a breakwater extending from Welch's Point about 890 feet long ; protection of bluffs from erosion on east shore of harbor by means of small jetties ; dredging a channel across the bar at the mouth of the Wepanwog River 100 feet wide and 4 feet deep ; construction of a jetty about 550 feet long on east side of channel to aid the action of the tide and to prevent the dredged area from refilling. Estimated cost, \$35,000, '73, 1043, 1044 ; '74, ii, 260 ; '86, 640.

The project except the breakwater was completed in 1881 under aggregate appropriations of \$33,000, when Maj. Barlow proposed the formation of a dredged channel through the bar at the mouth of the river from the bay to Merwin's Wharf 100 feet wide and 8 feet deep, at an estimated cost of \$11,000, '81, 599 ; '82, 614 ; '84, 96 ; '86, 641.

Surveys.

- Ordered by act of March 3, 1881, for a harbor of refuge, '82, 97. Made under direction of Maj. Barlow, 1882, '82, 632.

MAPS.

- '82, 614 ; '84, 648 ; '86, 640.

MILFORD HAVEN, VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

- Report, '84, 177.

ENGINEER IN CHARGE.

- Capt. J. Mercur. Report, '84, 1053.

Plans.

- In 1883 Capt. Mercur did not consider the locality worthy of improvement nor the work a public necessity, '84, 1054.

Surveys.

- Examination ordered by act of August 2, 1882. Made under direction of Capt. Mercur '84, 1053.

MILWAUKEE BAY, WIS.—HARBOR OF REFUGE AT.**Appropriations.**

1881.....	\$100,000, '81, 2115.
1882.....	100,000, '82, 2156.
1884.....	85,000, '84, 1864.
1886.....	60,000, '86, 1680.
Total	345,000
1888.....	70,000, act of August 11, 1888.

Contracts.

1881. J. W. Dennis, crib construction, '81, 2115.
 1882. C. H. Starke, crib construction, '83, 1704.
 1884. C. H. Starke, for crib construction, '85, 2017.
 1886. H. B. Herr, for crib construction, '87, 2056.

MILWAUKEE BAY, WIS.—Continued.**Commerce.**

Extent of commerce to be benefited by improvement and necessity for harbor of refuge, '81, 2119.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 210; '81, 260, 2120; '82, 275; '83, 284; '84, 284; '85, 307; '86, 301; '87, 266.

BOARD OF ENGINEERS.

Convened at Milwaukee, Wis., April 20, 1881, by S. O. No. 2, C. of E., to report upon project for harbor of refuge, Milwaukee Bay, '81, 2122. (Maj. Comstock, Weitzel, and Robert.)

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1880-'84. Reports, '81, 2113, 2123; '82, 2155; '83, 1703. Capt. W. L. Marshall, 1884'— Reports, '84, 1863; '85, 2015; '86, 1679; '87, 2055, 2060.

ASSISTANT.

W. H. Hearing. Reports, '81, 2114; '82, 2156; '83, 1704; '84, 1864; '85, 2017; '87, 2058.

Operations.

1881-'82. 600 linear feet crib-work built and sunk in construction of north arm of breakwater, '82, 2157.

1882-'83. 200 linear feet crib-work sunk, completing J. W. Dennis's contract for 1,600 linear feet of substructure; 550 linear feet crib substructure sunk under Starke's contract, '83, 1706.

1883-'84. 300 linear feet crib-work sunk in extension of north arm of breakwater and 850 linear feet superstructure built, '84, 1864.

1884-'85. 800 linear feet of crib-work built and placed in extension of breakwater, '85, 2017.

1885-'86. One crib placed in extension of breakwater; 1,600 linear feet superstructure built, '86, 1679.

1886-'87. Five cribs placed upon stone foundation in extension of east breakwater, '87, 2056. Injury to breakwater from ice, '87, 2056, 2058.

Projects.

By Col. Houston, 1880, for the formation of a harbor of refuge in Milwaukee Bay by an artificial harbor inclosing a part of Lake Michigan within an outer breakwater of crib-work upon a random stone foundation. Estimated cost, \$30,000, '81, 2117, 2119, 2121. Recommendations of Board of Engineers, '81, 2121, 2122.

Plan of Capt. Marshall for a concrete superstructure faced with cast-iron, '87, 2060.

Approved for trial by Board of Engineers, '87, 2061.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Houston, '81, 2116.

MAPS.

'83, 1704; '84, 1864; '85, 2016.

MILWAUKEE HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 306.)

Appropriations.

1886-'79	\$335,987.45
1880	10,000.00, '80, 1935.
1881	8,000.00, '81, 2125.
1882	10,000.00, '82, 2158.
Total	363,987.45
1888	10,000.00, act of August 11, 1888.

Commerce.

Benefit of improvement, '80, 1935.

Contracts.

1879. Stark, Smith & Co., for dredging, at 19½ cents per cubic yard, '80, 1935.

1880. Stark, Smith & Co., for dredging, at 23 cents per cubic yard, '81, 2125.

1881. Stark & Smith, for pile protection, superstructure, and repairs, '81, 2125.

1886. H. B. Herr & Co., for superstructure reconstruction, '87, 2062.

MILWAUKEE HARBOR, WIS.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 207, 210; '81, 280; '82, 276; '83, 284; '84, 285; '85, 308; '86, 302; '87, 267.

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1870-'84. Reports, '80, 1933; '81, 2124; '82, 2158; '83, 1706.

Capt. W. L. Marshall, 1884-'—. Reports, '84, 1866; '85, 2018; '86, 1680; '87, 2061.

ASSISTANT.

W. H. Hearing. Reports, '80, 1934; '81, 2124; '82, 2158; '83, 1706; '84, 1866; '85, 2019; '87, 2063.

Operations.

1879-'80. 30,000 cubic yards material dredged, '80, 1934.

1880-'81. 24,917 cubic yards material dredged, '81, 2124.

1881-'82. Pile protection driven along 1,131 linear feet of inner pier section; repairs to pile protection and superstructure, '82, 2158, 2159.

1882-'83. No operations, '83, 1706.

1883-'84. Repairs to piers, '84, 1866.

1884-'86. No operations, '85, 2018; '86, 1681.

1886-'87. 270 linear feet of north pier superstructure rebuilt, '87, 2062.

Projects.

The improvement of the natural outlet of the river was undertaken in 1843 by the sinking of cribs out to the 10-foot curve and the dredging of a channel between the piers, '76, ii, 3-5; '80, 1933.

The project from which the present improvement has grown was adopted in 1852 and proposed cutting across the point overlapping the mouth of the river at a point 3,000 feet north of the natural outlet. By the extension of parallel piers about 260 feet apart it was proposed to maintain a channel 12 feet deep.

In 1867 the project was modified to provide for a channel 16 feet deep, '68, 30; '69, 27.

In 1874 a stone superstructure for a part of the north pier was adopted, '74, i, 151; '75, i, 211; '77, 869. Since that date the project has been completed by the formation of a channel 18 feet deep by an aggregate of appropriations from 1852 to 1882 of \$313,587.45, and expenditures of the city of Milwaukee amounting to \$321,355.66, '82, 276.

Surveys.

Soundings between harbor piers, '83, 1706.

MAPS.

'84, 1866.

MINGO CREEK, S. C.—SURVEY OF.

[\$5,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 139.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1887. Report, '87, 1106, 1108.

Physical Characteristics.

Description, '87, 1106.

Plans.

By Capt. W. H. Bixby, 1887, for improvement of creek by removal of snags, logs, trees, and similar obstructions, over a distance of 21 miles, at a cost of \$16,632, '87, 1108.

Surveys.

Ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Bixby, '87, 1108.

MINISCEONGO CREEK, N. Y.—SURVEY OF OUTLET.**Commerce.**

Commercial statistics, '84, 715.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 106.

MINISCENONGO CREEK, N. Y.—Continued.**Engineers—Continued.**

ENGINEER IN CHARGE.

Col. J. Newton. Report, '84, 714.

Plans.

By Col. Newton, 1883, for the formation of a channel, by dredging and dike construction, 10 feet deep at low water, leading from the creek to the channel of the Hudson River. Estimated cost, \$93,400, '84, 715.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Col. Newton, '84, 714.

MINNESOTA RIVER, MINN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 308.)

Appropriations.

1867-'79 \$117,500

1888..... 10,000, act of August 11, 1888.

Statement of appropriations, '87, 1711.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 181, 183; '81, 243, 247; '82, 239; '83, 247; '84, 247, 250; '85, 270; '86, 260; '87, 227-229.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878-'—. Reports, '80, 1582; '81, 1754, 1831; '82, 1819; '83, 1447; '84, 1609, 1637; '85, 1741; '86, 1494; '87, 1710.

ASSISTANTS.

J. B. Parkinson. Report, '81, 1754.

R. Davenport. Report, '84, 1633, 1638.

Operations.

1879-'87. No operations for lack of funds, '80, 1582; '81, 1754; '82, 1819; '83, 1447; '84, 1609; '85, 1741; '86, 1494; '87, 1710.

Physical Characteristics.

Effect of freshets, '81, 1755.

Rate of river erosion at Belle Plain, '81, 1832.

Drainage area of source of river, '84, 1632.

Plans.

By Maj. Allen, 1882, for increasing the low-water discharge of the river by additions from a reservoir system at Big Stone Lake.

Maj. Allen considers that the commerce of the Minnesota River would not warrant the expense, '84, 1632.

Projects.

The project under which operations have been carried on since the date of the first appropriation in 1867 was the removal of snags, trees, rock, and bowlders from the channel. From 1867 to 1879, inclusive, \$117,500 was appropriated and applied towards this project, '67, 259; '80, 181; '86, 1496.

The project of 1867 for the permanent improvement of the river, modified by the surveys of 1874-'75, proposed a slack-water navigation from the mouth to South Bend, 116 miles, by means of canals, locks, and dams, at an estimated cost, including \$34,585.10 for clearing the river of obstructions, of \$733,868.63, '67, 260; '75, i, 364; '86, 261; '87, 1710. Of this estimate \$30,000 was expended between 1875 and 1879 in clearing the river of obstructions, '86, 1496.

Surveys.

Near Belle Plain ordered by act of June 14, 1880, '80, 163. Made under direction of Maj. Allen, 1880, '81, 1831; '84, 1637.

At the source of the river ordered by act of August 2, 1882, '84, 250. Made under direction of Maj. Allen, 1882, '84, 1632.

Examination ordered by act of August 5, 1886, with a view to improvement by locks and dams, '87, 229.

MISPELLION CREEK, DEL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 310.)

Appropriations.

1879.....	\$3,000
1880.....	4,000, '80, 589.
1881.....	3,500, '81, 786.
1882.....	3,000, '82, 769.

Total 13,500

1898..... 3,500, act of August 11, 1898.

Statement of appropriations, '87, 834.

Commerce.

Benefit of improvement, '82, 769.

Contracts.

1879. American Dredging Company, for dredging, at 35 cents per cubic yard, '80, 589.

1880. American Dredging Company, for dredging, at 45 cents per cubic yard, '81, 785.

1881. F. Pidgeon, jr., for dredging, at 43 cents per cubic yard, '81, 786.

1882. F. Pidgeon, for dredging, at 43 cents per cubic yard, '82, 769. American Dredging Company, for dredging, at 44 cents per cubic yard, '83, 625.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 95; '81, 123, 129; '82, 121, '83, 121; '84, 131; '85, 130; '86, 127; '87, 90.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1879-'81. Reports, '80, 587; '81, 785.

Capt. W. Ludlow, 1881-'82. Report, '82, 768.

Lient. Col. G. Weitzel, 1882-'84. Report, '83, 625.

Maj. W. H. Heuer, 1884. Report, '84, 829.

W. F. Smith, U. S. Agent, 1884-'— . Reports, '85, 878; '86, 861; '87, 833.

ASSISTANT.

J. N. Odiome. Report, '83, 626.

Operations.

1879-'80. 7,340 cubic yards material dredged, '80, 588.

1880-'81. 7,580 cubic yards material dredged, '81, 785.

1881-'82. 6,343 cubic yards material dredged, '82, 768.

1882-'83. 5,720 cubic yards material removed, '83, 626.

1883-'87. No operations, '84, 829; '85, 878; '86, 861; '87, 833.

Projects.

By Col. Macomb, 1879, for the formation of a low-water channel from Milford to the bar at the mouth, 6 feet deep and 40 feet wide, with repairs to existing pile structures at the mouth so as to prevent littoral sand drift. Estimated cost, \$10,000, '79, 467.

By Lieut. Col. Weitzel, 1883, for 4-foot low-water channel through bar at mouth. Estimated cost, \$55,000, making, together with \$3,500 for completion of former project, \$58,500, '83, 625, 626.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Ludlow, '82, 769.

MISSISSIPPI RIVER.

The index for this river is arranged under the following titles, namely:

Mississippi River, reservoirs at sources of.

Mississippi River, above the Falls of Saint Anthony.

Mississippi River, preservation of Falls of Saint Anthony.

Mississippi River, Meeker's Island Lock and Dam.

Mississippi River, from Saint Paul to Des Moines Rapids.

Mississippi River, from Des Moines Rapids to the mouth of the Illinois River.

Mississippi River, between the mouths of the Illinois and Ohio rivers.

Mississippi River (Upper), removal of snags and obstructions.

Mississippi River (Lower), removing snags and wrecks from.

Mississippi River, between the mouth of the Ohio River and the Head of the Passes.

Mississippi River, at its mouth.

Mississippi River, water-gauges on.

MISSISSIPPI RIVER—Continued.

Under the above titles, localities for which special appropriations have been made are arranged in their geographical order from north to south. They include the following:

Guttenburgh, Iowa.
Dubuque, Iowa.
Rock Island Harbor, Ill.
Andalusia, Ill.
Muscatine, Iowa.
Burlington, Iowa.
Fort Madison, Iowa.
Alexandria Harbor, Mo.
Quincy Harbor, Ill.

Quincy Bay, Ill.
Hannibal, Mo.
Louisiana, Mo.
Alton Harbor, Ill.
Cape Girardeau, Mo.
Memphis Harbor, Tenn.
Vicksburg Harbor, Miss.
Natchez and Vidalia Harbors, Miss. and La.
New Orleans Harbor, La.

MISSISSIPPI RIVER—RESERVOIRS AT SOURCES OF.

(Continued from Vol. I, p. 311.)

Appropriations.

1878-79	\$45,000
1880, survey	{ 15,000, '80, 1590.
	{ 75,000, '80, 1860.
1881	150,000, '81, 1762.
1882	300,000, '82, 1831.
1884	60,000, '84, 1616.
1886	37,500, '86, 1507.

Total 682,500.

1886 12,000, act of August 11, 1868.

Statement of appropriations, '86, 1506; '87, 1672.

Commerce.

Benefits arising from reservoir system, '80, 1596, 1611.

Effect of dams already built on the low-water stages, '86, 1503; '87, 1669, 1691.

Engineers.**CHIEF OF ENGINEERS**

Reports, '80, 182; '81, 245, 246; '82, 241; '83, 243, 249; '84, 249; '85, 272, 273; '86, 263; '87, 224, 1680.

BOARD OF ENGINEERS.

Constituted by S. O. No. 90, C. of E., 1880, to examine and report upon the project of Maj. Allen for a dam at outlet to Lake Winnibigoshish. Report, '81, 1763-1765. (Majs. Houston, Robert, and Lydecker and Capt. Allen.)

Reconvened September, 1882, to consider modifications proposed by Maj. Allen for Winnibigoshish Dam. Report, '83, 1471, 1472.

Mississippi River Commission. Report, '81, 2747, 2753. Convened at New York May, 1887, to consider and report upon the effect of the reservoir system on the river below Saint Paul. Report, '87, 1681-1693.

The Board did not favor the extension of the system to Saint Croix, Chippewa, and Wisconsin rivers at present, '87, 1680, 1692. (Cols. Casey and Abbot, Lieut. Cols. Houston and McFarland, and Maj. King.)

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878-—. Reports, '80, 1590, 1659; '81, 1761, 1766, 1770, 1807; '82, 1828, 1833; '83, 1455, 1473, 1476; '84, 1614; '85, 1747, 1749; '86, 1501; 1507; '87, 1686.

ASSISTANTS.

J. D. Skinner. Report, '80, 1595.

V. D. Limar. Report, '80, 1615.

A. Johnson. Reports, '80, 1624; '87, 1673.

J. D. Reynolds. Report, '80, 1632.

J. P. Frizell. Reports, '81, 1765, 1769, 1809; '82, 1835.

G. O. Foss. Report, '81, 1773, 1795.

W. S. Morton. Report, '81, 1783.

R. Davenport. Reports, '81, 1795; '84, 1530, 1633, 1635.

C. Wanzel. Reports, '81, 1802; '82, 1831; '83, 1461.

J. B. Parkinson. Reports, '83, 1465; '84, 1619.

C. McClellan. Report, '84, 1616.

Encroachments.

Injurious effect on the river arising from improper impounding of water by private interests, '86, 1504; '87, 1669, 1670.

Necessity for protective legislation, '87, 1691.

MISSISSIPPI RIVER—Continued.**Estimates.**

- For reservoirs on Mississippi River, '80, 1614; '81, 1768, 1775, 1777, 1781, 1789, 1791, 1796; '83, 1460.
- For reservoirs on Saint Croix River, '80, 1603, 1615, 1639, 1645; '81, 1781.
- For reservoirs on Chippewa River, '80, 1607, 1615, 1748; '81, 1781.
- For reservoirs on Wisconsin River, '80, 1609, 1615, 1638; '81, 1781.
- For reservoirs on Rock River, '81, 1807, 1812.
- For reservoirs on Cannon River, '84, 1635.
- For reservoirs on Minnesota River, '84, 1632.
- For increasing height of Pokegama Dam, '86, 1506.

Judicial Proceedings.

- Opinion of Attorney-General relative to lands to be overflowed by construction of dams, '81, 1781.
- Action of U. S. Commission in the appraisement of lands, '82, 1828.
- Action relating to overflowed lands, '84, 1617.
- Necessity for protective legislation, '87, 1691.

Operations.

- 1881-'82. Commencement, by hired labor, of the construction of Winnibigoshish Dam, '82, 1829, 1831.
- 1882-'83. Progress on Winnibigoshish Dam, commencement of Leach Lake Dam, and preparations for construction of Pokegama Dam, '83, 1455, 1456, 1461, 1464. Cost of materials and labor, '83, 1463, 1465.
- 1883-'84. Progress on Winnibigoshish, Leach Lake, and Pokegama dams; commencement of Pine River Dam at outlet of Cross Lake, '84, 1614.
- 1884-'85. Completion of Winnibigoshish, Leach Lake, and Pokegama dams; progress on Pine River Dam; capacity of dams, '85, 1747; '87, 1668.
- 1885-'86. Progress on Pine River Dam; description and capacity of, '86, 1502. Operation of Winnibigoshish, Leach Lake, and Pokegama dams, '86, 1503. Effect of dams on low-water stages, '86, 1503.
- 1886-'87. Completion of Pine River Dam; description of dam and its capacity, '87, 1667, 1668, 1674.

Physical Characteristics.

- Rainfall observations, '80, 1591, 1600, 1612; '81, 1778, 1801; '82, 1834; '83, 1458; '84, 1622.
- Discharge of Upper River, '80, 1593, 1599; '81, 1799, 1801, 1806; '83, 1467; '84, 1621, 1627; '87, 1689, 1698.
- Ratio of rainfall to drainage, '80, 1591, 1597; '81, 1774, 1780, 1781, 1801, 1807; '83, 1457, 1469.
- Effect of reservoirs on river, '80, 1611; '86, 1503; '87, 1669, 1682, 1685, 1687.
- Drainage areas of upper river, '81, 1773, 1774, 1777, 1790; '83, 1467; '87, 1689.
- Borings at Gull Lake Dam site, '81, 1784.
- Borings at Pine River Dam site, '81, 1788.
- Elevation of points in Minnesota, Wisconsin, and Dakota, '81, 1812.
- Effect of temperature on velocity of discharge, '83, 1470; '84, 1619.
- Thickness of ice, '84, 1620.
- Depth on bars below Saint Paul, '87, 1694.

Projects.

- Since 1870 various plans have been proposed for the improvement of the Mississippi River above Lake Pepin by a system of reservoirs at the sources of the Mississippi and its upper principal tributaries, by which the flood water could be impounded and subsequently discharged during the season of low water, '70, 285-287; '75, ii, 441; '79, 1206-1223.
- In 1880, following the appropriation of June 14, 1880, the project of Maj. Allen was adopted, providing for the collection of the surplus water during winter, spring, and early summer, and its systematic release during the seasons of low water. The project provided for the construction of 41 reservoir dams upon the headwaters of the Mississippi, Saint Croix, Chippewa, and Wisconsin rivers, at an estimated cost, exclusive of land damages, of \$1,809,083.50, '81, 1761, 1763, 1770, 1781, 2748, 2753; '82, 1830; '85, 1749.
- Description of dams, '81, 1763; '83, 1456, 1472; '87, 1667, 1678.
- The Board of Engineers of 1880 approved of the location and general plan of the dam proposed by Maj. Allen at the outlet of Lake Winnibigoshish, on the Mississippi River, with recommended modifications in dimensions and construction, '81, 1763. Modifications adopted in 1882, '83, 1472-1474.
- Effect of dams on low-water stages, '86, 1503; '87, 1669, 1682, 1685, 1687.
- Consideration of further extension of system; Board of Engineers, 1887, do not consider that at present the system should be extended to the Saint Croix, Chippewa, and Wisconsin rivers, '87, 1680, 1690, 1692.

MISSISSIPPI RIVER—Continued.**Surveys.**

- At sources of Mississippi, '80, 1590, 1597; '81, 1761, 1783, 1802; '82, 1833, 1835.
 At sources of Saint Croix, '80, 1601, 1615.
 At sources of Chippewa, '80, 1607, 1624.
 At sources of Wisconsin, '80, 1609-1632.
 At sources of Rock River, '81, 1770, 1807.
 At sources of Cannon River, '82, 1833; '84, 1834.
 At sources of Minnesota River, '84, 1632.

MAPS.

- Showing proposed sites of reservoirs, '80, 1600.
 Drainage area of Pine River reservoir, '81, 1790.
 Proposed location of dam at Pokegama Falls, '81, 1800.
 Drainage area of Rock River, '81, 1808.
 Showing progress on Winnibigoshish Dam, '83, 1456.

MISSISSIPPI RIVER above the Falls of Saint Anthony.
 (EXCEPT RESERVOIRS AT SOURCES OF.)

(Continued from Vol. I, p. 313.)

Appropriations.

For appropriations previous to 1880, see Index, Vol. I, page 313.

- 1880..... \$15,000, '80, 1574.
 1881..... 10,000, '81, 1744.
 1882..... 10,000, '82, 1804.
 1888..... 10,000, act of August 11, 1888.
 Statement of appropriations, '86, 1484.

Commerce.

- Limited commerce of upper river, '80, 1573, 1574; '86, 257.
 Freight rates on upper river, '87, 1666.

Encroachments.

- Injury to works from loggers, '80, 1573; '81, 1834.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80' 178; '81, 240, 247; '82, 237; '83, 244; '84, 245; '85, 267; '86, 256; '87, 224.

ENGINEER IN CHARGE.

- Maj. C. J. Allen, 1878.—. Reports, '80, 1572; '81, 1743, 1832; '82, 1803; '83, 1435; '84, 1597; '85, 1731; '86, 1483; '87, 1664.

ASSISTANTS.

- R. Davenport. Reports, '81, 1745; '82, 1804.
 F. Terry. Report, '83, 1436.
 J. P. Frizell. Report, '81, 1835.

Operations.

- 1879-'80. No operations, '80, 1572.
 1880-'81. Removal of bowlders, snags, and trees, and construction of wing-dams at rapids between Aiken and Grand Rapids, '81, 1743, 1746.
 1881-'82. Removal of bowlders and snags and construction of wing-dams between Aiken and Grand Rapids above the Northern Pacific Railroad, '82, 1803, 1805.
 1882-'83. Continuation of work between previous limits, '83, 1435, 1437.
 1883-'84. Continuation of work between previous limits, '84, 1598.
 1884-'85. Removal of bowlders from Grand Rapids, '85, 1731.
 1885-'87. No operations from lack of funds, '86, 1483; '87, 1664.

Physical Characteristics.

- Discharge of upper river, '81, 2744; '82, 1807.
 Drainage basin, area of upper, '81, 2743.
 Slope of river, '81, 2744.
 Caving banks, '87, 1664.

Plans.

- By Maj. Allen, 1880, for the passage of Sauk Rapids, Minn., by means of a lock and dam. Estimated cost, from \$461,000 to \$647,000, '81, 1833, 1836.

Projects.

- By Maj. Farquhar, 1874, for the improvement of the river between Minneapolis and Saint Cloud to a depth of 5 feet, by the removal of sand, gravel, and bowlder bars, and the construction of wing-dams. Estimated cost, \$144,667, '75, i, 359; ii, 449-452; '86, 1483; '87, 1664.

MISSISSIPPI RIVER—Continued.**Projects—Continued.**

The appropriations of \$45,000, made 1874-'76, were expended on this project, '79, 1166; '80, 1572.

Since 1880 operations have been carried on under the project for the improvement of the river between Aiken and Grand Rapids, 165 miles, by the removal of snags, trees, and bowlders, and the construction of wing-dams, so as to afford 3 feet depth during low-water stages. The estimated cost for this improvement from Conradi's Shoals to Grand Rapids, 252 miles, was \$54,127.50, '75, ti, 450-453; '80, 1573; '86, 1484; '87, 1664.

Surveys.

At Sauk Rapids, Minn., ordered by act of June 14, 1880, '81, 247. Made under direction of Maj. Allen, 1880, '81, 1832.

MAPS.

Moose Rapids, '81, 1746.

Sandy Lake Rapids, '81, 1746.

Ox Portage Rapids, '81, 1746.

Crooked Rapids, '81, 1746.

Pine Rapids, '81, 1746.

MISSISSIPPI RIVER—PRESERVATION OF THE FALLS OF SAINT ANTHONY.

(Continued from Vol. I, p. 314.)

Appropriations.

1870-'79	\$580,000
1880	10,000, '80, 1567.
1881	15,000, '81, 1741.
1882	25,000, '82, 1801.
1884	10,000, '84, 1597.

Total 640,000

List of appropriations from 1870 to 1886, '86, 1442; '87, 1661.

Encroachments.

Of mill owners and others, '82, 236, 1800; '83, 1432; '84, 1596; '85, 1722, 1729.

Danger to works of United States by insecure condition of private dam, '85, 1723, 1727.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 178; '81, 239; '82, 236; '83, 248; '84, 244; '85, 266, 1726; '86, 255; '87, 223.

BOARD OF ENGINEERS.

Constituted by S. O. No. 5, C. of E., 1886, to examine and report upon probable effect of proposed bridge at Minneapolis upon works of the United States for the preservation of the falls. Report, '86, 2111-2116. (Lieut. Col. Poe, Majs. Mackenzie and Allen.)

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878-'—. Reports, '80, 1565, 1568; '81, 1739; '82, 1800; '83, 1431; '84, 1596; '85, 1721, 1729; '86, 1479; '87, 1660.

ASSISTANT.

R. Davenport. Report, '85, 1725.

Legal Proceedings.

Against J. B. Bassell, for encroachments on Government works, '82, 236, 1800; '85, 1729.

Operations.

History of past operations, '85, 1722; '86, 1480.

1879-'80. Construction of log sluice at westerly end of apron and protection and repair of toe of apron, '80, 1565, 1568, 1570.

1880-'81. Repairs to apron by cribs placed at lower end, '81, 1740.

1881-'82. Preparations for repairs to apron, '82, 1800.

1882-'83. Repairs to apron in progress, '83, 1432.

1883-'84. No operations for lack of funds, '84, 1596.

1884-'85. Repairs to aprons, '85, 1723.

1885-'87. No operations for lack of funds, '86, 1482; '87, 1662.

MISSISSIPPI RIVER—Continued.**Physical Characteristics.**

Low-water discharge at Minneapolis, '81, 1743.

Description of falls, '86, 1480; '87, 1660.

Rate of recession, '86, 1480; '87, 1660.

Plans.

In 1885 Maj. Allen proposed extending the main apron in front of Farnham & Lovejoy's Dam, removal of a part of a point of rocks in the river, continuing the line of submerged cribs across the bed of the river at the toe of the apron, and repairing the main and east apron. Estimated cost, \$210,000, '85, 1724, 1727; '86, 1481.

Private and Corporate Work.

Tunnel between Hennepin and Nicollet islands built by mill owners in 1868, '85, 1722; '87, 1660.

Expenditures by citizens of \$334,000 to arrest threatened destruction of falls, '85, 1722.

Danger to works of United States arising from insecure private dam, '85, 1723, 1727, 1730.

Proposed construction of stone bridge just above the falls, '86, 1481, 2111.

Projects.

Previous to the adoption of the project of 1874 \$200,000 had been appropriated and applied towards closing the tunnel between Hennepin and Nicollet islands by timber and masonry bulkheads and the filling of the upper part of the tunnel with clay and puddle, '71, 257-294; '72, 297; '73, 408-410; '74, i, 277; '85, 1722.

The project of 1874 provided for the construction of a concrete dike across the river and underneath the limestone ledge, the construction of flooding or rolling dams to protect the upper surface of the ledge, and the construction of a timber apron and wings to prevent the recession of the crest of the falls, '74, i, 284; '76, i, 699; '85, 1722; '86, 255, 1440. The estimated cost was \$419,792, '74, i, 285. Increased in 1876 to \$529,726.31, '76, i, 700; '78, 726. Reduced in 1884 to original estimate, '84, 1596; '86, 1481. The dike was completed in 1876 and remaining works in 1878, '77, 565; '79, 1159-1165; '86, 255.

In 1879 a log sluice was placed at the westerly side of the apron, '80, 1565; '86, 1480.

Surveys.**MAPS.**

'82, 1800; '83, 1434; '85, 1720.

MISSISSIPPI RIVER—MEEKER'S ISLAND LOCK AND DAM.

(Continued from Vol. I, p. 316.)

Appropriations.

1873..... \$25,000, '73, 51; '86, 268.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 179; '81, 241; '82, 237; '83, 241; '84, 245; '85, 268; '87, 223.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878.— Reports, '80, 1575; '81, 1747; '82, 1809; '83, 1438; '84, 1599; '85, 1733; '86, 1485; '87, 1663.

Legislation.

Act of July 23, 1863, granting State of Minnesota 200,000 acres of land in aid of construction of lock and dam, '73, 411; '81, 1747.

Act of March 3, 1873, requiring the relinquishment of grant before the application of appropriation, '73, 411; '81, 1747.

Operations.

(See LEGISLATION.)

Private and Corporate Work.

200,000 acres of public land granted by act of July 23, 1863, to State of Minnesota in aid of construction of lock and dam, '73, 411; '81, 241.

Provision of act of March 3, 1873, requiring relinquishment of grant before application of the appropriation of 1873, '73, 411; '81, 1747.

MISSISSIPPI RIVER—Continued.**Projects.**

By Maj. Warren, 1867, modified in 1874, so as to provide for a lock and dam across the river at Meeker's Island; timber dam, with lock of 17 feet lift, with faces of granite masonry; dimensions of lock, 300 feet by 80 feet. Estimated cost, \$922,121, '67, 259; '74, i, 287; '81, 1747.

(See also LEGISLATION.)

Surveys.

Between Saint Paul and Minneapolis ordered by act of August 5, 1886, '87, 230, 1663.

MISSISSIPPI RIVER, FROM SAINT PAUL TO DES MOINES RAPIDS. (EXCEPT HARBOR OF REFUGE IN LAKE PEPIN, ICE-HARBOR AT DUBUQUE, ROCK ISLAND RAPIDS, AND DES MOINES RAPIDS.)

Appropriations.

For appropriations previous to 1880, see Index, Vol. I, page 317.

1880.....	\$150,000, '80, 1495.
1881.....	200,000, '81, 1688.
1882.....	250,000, '82, 1757.
1884.....	250,000, '84, 1554.
1886.....	382,500, '86, 1421.
1881, Guttenburgh, Iowa.....	5,000, '81, 1700.
1880, Dubuque, Iowa.....	7,000, '80, 1533.
1881, Dubuque, Iowa.....	5,000, '81, 1701.
1880, Rock Island Harbor.....	6,000, '80, 1539.
1881, Rock Island Harbor....	6,000, '81, 1703.
1881, Andalusia, Ill.....	6,000, '81, 1704.
1880, Muscatine, Iowa.....	7,500, '80, 1540.
1881, Muscatine, Iowa.....	2,500, '81, 1707.
1882, Muscatine, Iowa.....	2,500, '82, 1775.
1880, Burlington, Iowa.....	5,000, '80, 1541.
1881, Fort Madison, Iowa....	2,500, '81, 1715.
1888.....	600,000, act of August 11, 1888.

Contracts.

1879. Winston Brothers, for shore protection, at Hastings, '80, 1497. S. J. Truax, for shore protection and dams, at Smith's Bar, '80, 1497. Jenkins & Van Gorder, for shore protection and dams at Mount Vernon Bar and Winona, '80, 1499. Whitney & Sons, rock removal near Horse Island and dredging at Keithsburg, '80, 1505. Brown & Co., for dredging, at Dubuque, at 17 cents per cubic yard, '80, 1534.
1880. S. J. Truax, for shore protection and dams above Red Wing and below Wabasha, '81, 1689. J. Richtman, for shore protection and brush dams near Fountain City and above Winona, '81, 1689. Whitney & Sons, for dredging, at Rock Island Harbor, at 20 cents per cubic yard, '80, 1704; for dredging, at Muscatine, at 20 cents per cubic yard, '81, 1706.
1881. S. J. Truax, for shore protection and dams between Reed's Landing and Wabasha, '81, 1690. A. J. Whitney & Sons, for dredging, at 98 cents per cubic yard, below Keithsburg, '81, 1690. Whitney & Sons, for dredging, at Dubuque, at 25 cents per cubic yard, '82, 1763; for construction of dams and shore protection, at Andalusia, '81, 1705.
1882. P. S. Davidson, for shore protection and dams between La Crosse and Brownsville, and between Homer and Queen's Bluff, '83, 1387, 1388. J. Richtman, for shore protection and dams between Mount Vernon and Fountain City, '83, 1388.
1883. B. E. Linehan, for dredging, at Dubuque, for 12 cents per cubic yard, '84, 1571.
1884. A. J. Whitney, for dredging, at Muscatine, for 16 cents per cubic yard, '84, 1675.
1885. A. D. Fleak, for construction of dredge hull, '85, 1673. Truax & Robinson, for furnishing poles and brush, '85, 1673. Patterson Brothers, for furnishing riprap, '85, 1674. C. H. Appleton, for dredging, at Saint Paul, at 16½ cents per cubic yard, '85, 1675. T. G. Isherwood, for construction of six flat-boats, '85, 1675. M. Von Hein, for construction of six dump-boats, '85, 1675.
1887. A. Richtman, for dams and shore protection; S. D. Truax, for dams and shore protection; A. Kerchner, for riprap rock; W. M. Roberts & Co., for riprap rock, '87, 1624, 1629.

MISSISSIPPI RIVER—Continued.

Engineers.**CHIEF OF ENGINEERS.**

From Saint Paul to Des Moines Rapids. Reports, '80, 171; '81, 232; '82, 229; '83, 235; '84, 239; '85, 261; '86, 250; '87, 219.

Guttenburgh, Iowa. Reports, '81, 233; '82, 230; '83, 237; '85, 266.

Dubuque, Iowa. Reports, '80, 172; '81, 233; '82, 230; '83, 237; '84, 240; '85, 262; '86, 252; '87, 221.

Rock Island Harbor, Ill. Reports, '80, 173; '81, 234; '82, 231; '83, 238; '84, 241; '85, 263.

Andalusia, Ill. Reports, '80, 177; '81, 234; '82, 231; '83, 238.

Muscataine, Iowa. Reports, '80, 173; '81, 234; '82, 231; '83, 238; '84, 241.

Burlington, Iowa. Reports, '80, 174; '81, 235.

Fort Madison, Iowa. Reports, '80, 174; '81, 235; '82, 232; '83, 239.

BOARD OF ENGINEERS.

Mississippi River Commission. Report, '81, 2742, 2755.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1880-'—:

From Saint Paul to Des Moines Rapids. Reports, '80, 1493, 1532; '81, 1686, 2755; '82, 1754; '83, 1382; '84, 1550; '85, 1669, 1710; '86, 1412; '87, 1623.

Guttenburgh, Iowa. Reports, '81, 1700; '82, 1767; '83, 1405; '85, 1718.

Dubuque, Iowa. Reports, '80, 1532; '81, 1700; '82, 1768; '83, 1405; '84, 1571, '85, 1691; '86, 1424, 1425; '87, 1653.

Rock Island Harbor, Ill. Reports, '80, 1539; '81, 1703; '82, 1773; '83, 1411; '84, 1576; '85, 1695.

Andalusia, Ill. Reports, '81, 1704; '82, 1774; '83, 1411.

Muscataine, Iowa. Reports, '80, 1539; '81, 1706; '82, 1775; '83, 1411; '84, 1575.

Burlington, Iowa. Reports, '80, 1541; '81, 1707.

Fort Madison, Iowa. Reports, '80, 1541; '81, 1715; '82, 1776; '83, 1412.

ASSISTANTS.

J. L. Gillespie. Reports, '80, 1496; '81, 1690; '82, 1757; '83, 1388; '84, 1554; '85, 1676.

M. Meigs. Reports, '80, 1499, 1534; '81, 1692; '82, 1759; '87, 1637.

E. F. Hoffman. Reports, '80, 1504; '81, 1695; '82, 1761; '83, 1392; '84, 1558.

C. W. Durham. Reports, '84, 1559, 1575; '85, 1679; '86, 1415; '87, 1631.

G. A. Marr. Report, '85, 1684.

Operations.

Between Saint Paul and Des Moines Rapids:

1879-'80. Construction of brush and stone dams and shore protection at Hastings, Prescott, Smith's Bar, Crat's Island, Beef Slough, Mount Vernon, Rolling Stone, Betsy Slough, Winona, La Crosse, and Cassville Slough, and in dredging and removal of bowlders at Horse Island, Smith's Island, and Keithsburg, '80, 1496-1505.

At Dubuque: 19,573 cubic yards dredged from bar in front of landing, '80, 1534.

At Muscatine: 15,107 cubic yards dredged from bar in front of landing, '80, 1540.

At Fort Madison: Raising Niola Chute Dam, construction of dike between Islands 390 and 391, shore protection at foot of Island 391, and dredging at ferry landing, '80, 1542.

1880-'81. Construction of brush and stone dams, and shore protection at Nininger Slough, Red Wing, Wabasha, Beef Slough, Pomme de Terre Slough, Rolling Stone, Winona, Cassville Slough, Guttenburgh, Rush Chute, and Shokokou Slough; rock removal at Horse Island and dredging at Keithsburg, '81, 1687, 1690-1695.

At Guttenburgh: Commencement of dam for closing Smith's Slough, '81, 1700.

At Rock Island Harbor: 7,402 cubic yards dredged from bar, '81, 1703.

At Muscatine: 23,830 cubic yards dredged from bar, '81, 1706.

At Burlington: Strengthening of Rush Chute Dam, and placing of shore protection at head of island and the chute, '81, 1708.

1881-'82. Construction of brush and stone dams, and shore protection between Saint Paul and Hastings; between Reed's Landing and Wabasha at Rolling Stone, Betsy Slough, near Wild's Landing, Winona, Rush Chute, and Shokokou Slough, and dredging in Coon Slough Bends, '82, 1754, 1757-1763.

At Guttenburgh: Completion of Smith's Slough Dam, '82, 1767.

At Dubuque: 3,570 cubic yards dredged from shoal near Terry Landing at East Dubuque, '82, 1767.

At Rock Island Harbor: 407 cubic yards dredged from bar, '82, 1773.

At Andalusia: Progress on dam construction and shore protection at Islands 319, 230, and 321, '82, 1774.

MISSISSIPPI RIVER—Continued.**Operations—Continued.**

At Muscatine: 18,294 cubic yards dredged from bar and mouth of Papoose Creek, '82, 1775.

History of past operations, '81, 2757.

1869-'83. Construction of brush and stone dam and shore protection between Saint Paul and Hastings, at Alma, Wabasha, Homer, Queen's Bluff, Mount Vernon, Fountain City, La Crosse, Brownsville, Guttenburgh, Cassville Slough, Rush Chute, Shokokon Slough, and Montrose, '83, 1383-1395.

At Guttenburgh: 1,520 feet of shore protection placed on island opposite the town, '83, 1406.

At Fort Madison: 1,320 feet of shore protection placed at heads of Islands 392 and 393, '83, 1412.

1883-'84. Construction of brush and stone dams and shore protection between Saint Paul and Hastings; between Homer and Queen's Bluff, near Winona, at Fort Madison and Montrose, and dredging below Minneiska, '84, 1551, 1554-1560.

At Dubuque: 23,436 cubic yards dredged from middle grounds and in front of East Dubuque Landing, '84, 1571.

Survey of Rock Island Harbor, '84, 1575.

At Muscatine: 17,251 cubic yards dredged from bar, '84, 1575.

1884-'85. Construction of brush and stone dams and shore protection between Saint Paul and Hastings; between Reed's Landing and Winona, at La Crosse, Fountain City, Cassville Slough, Guttenburgh, Andalusia, and Fort Madison; dredging near Bad Axe, at harbors of Muscatine and Fort Madison, Rock Island Rapids; construction of dredge and dump scows, '85, 1667, 1669, 1676-1685.

At Rock Island Harbor: 18,558 cubic yards dredged from bar, thereby completing all work required, '85, 1696.

1885-'86. Construction of brush and stone dams and shore protection at Saint Paul, between Saint Paul and Hastings, in vicinity of Fountain City, and at Coon and Cassville sloughs; dredging below Alma and at West Saint Paul, '86, 1412-1416.

At Dubuque: 37,968 cubic yards dredged from upper part of bar, '86, 1425.

Comparative cost of dredging from 1878 to 1885, '86, 1407.

1886-'87. Dam and shore protection constructed and repaired between Saint Paul and Hastings, at Red Rock, between Homer and Queen's Bluff, Otter Island and Nauvoo, at Crooked Slough, Chimney Rock, Andalusia and Rolling Slough; rock removed at Rock Island Rapids, Drew's Prairie, and Dallas; wrecks removed at Hastings and Wabasha; removal of bar at foot of Coon Slough, '87, 219, 1623, 1631-1639; 4,677 cubic yards dredged from bar opposite Dubuque, '87, 1653.

Physical Characteristics.

Specific gravities of sand, '80, 1504.

Current observations at Burlington, '81, 1708.

Depths before and after improvement, '81, 2446.

Character of material in bed of river, '81, 2734; '83, 2758.

Slope of river, '81, 2744.

Discharge of, '81, 2744.

Plans.

The act of July 5, 1884, required a report concerning the value of the Sny Island Levee to the improvement of the river and an estimate for strengthening and preserving the levee so as to maintain its benefit. Maj. Mackenzie did not consider that as a levee it had benefited navigation except as a closure to certain chutes. The cost of strengthening such closing parts was estimated at \$16,515, '85, 1710-1717.

Projects.

The general project for the improvement of the river between Saint Paul and Des Moines Rapids is the gradual bringing of the river into one channel by the construction of brush and stone dams, by which chutes are closed and wide places contracted; also the protection of caving banks and heads of islands. At special localities dredging is resorted to as an aid to the contracting and regulating works, '81, 2745; '83, 1383.

AT SPECIAL LOCATIONS.

At Guttenburgh, Iowa, the project was the closure of Swift's Slough and the protection of the head of the island opposite the town, '81, 1694, 1700; '85, 1720.

At Dubuque, Iowa, the project of 1876 proposed the formation of an artificial cut from Waple's to New Barney's cuts; also the closure of Seventh Street Slough, New Barney's and Waple's cuts, '76, i, 696. Modified in 1877 for temporary improvement of the bar by dredging and subsequently its permanent improvement by the construction of a training dike from the upper end of New Barney's Cut to the railroad bridge, '77, 525.

MISSISSIPPI RIVER—Continued.**Projects—Continued.**

In 1879 a Board of Engineers recommended the improvement of the bar by the construction of two contracting dikes from the Dunleith Shore if the dredged channel then in progress in front of Dubuque Wharf showed signs of refilling. Estimated cost of dikes, \$12,663, '79, 1143; '80, 1532. The success of dredging alone having been demonstrated, the construction of dikes has been omitted, '86, 1424.

At Rock Island Harbor the project of 1879 proposed the removal, by dredging, of the bar along the levee and a part of the large bar extending from the foot of Rock Island, covering the steam-boat landing. Estimated cost, \$28,759.15, '80, 1539; '85, 1695. Project completed in 1884, '85, 1696.

At Andalusia, Ill., the project of 1880 proposed the improvement of the channel of approach between the main channel and the landing by the construction of dams between the Illinois shore and Island 321, between Islands 320 and 321, and between Islands 318 and 319, together with the necessary shore protection. Estimated cost, \$18,000, '81, 1705, 1706.

At Muscatine, Iowa, the project of 1879 proposed the temporary improvement of the bar in front of the city landing by dredging. Estimated cost, \$19,250, '79, 1137; '80, 1540.

At Burlington Harbor, Iowa, the project of 1875-'79 proposed the improvement of Rush Chute by the removal of the bar at its head by dredging and the contraction of the channel at the foot of the chute by rectifying dams with shore protection. Estimated cost, \$69,656.57, '76, i, 691, 693; '79, 1138; '80, 1541. After 1881 this improvement was carried on under appropriations for improving the Mississippi River between Saint Paul and Des Moines Rapids, '81, 1708.

At Fort Madison the project of 1875 proposed the closing of Niota Chute and the protection of the heads of adjacent islands, '76, i, 688; '79, 1139.

Surveys.

At Guttenburgh, ordered by act of July 5, 1884. Made under direction of Maj. Mackenzie, 1884, '85, 1718.

At Andalusia, ordered by act of March 3, 1879. Made under direction of Maj. Mackenzie, 1880, '81, 1705.

From the Falls of Saint Anthony to Saint Paul, ordered by act of March 3, 1879. Made under direction of Maj. Allen, 1879, '80, 1660.

Examination of Guy Island Levee ordered by act of July 5, 1884. Made under direction of Maj. Mackenzie, '85, 1710, 1717.

MAPS.

Below Nininger, Minn., '84, 1554.

At Pine Bend, '84, 1558.

Bellevue Bar, '80, 1506.

Beef Slough, '80, 1506.

Mount Vernon Bar, '80, 1506.

Winona Bar, '80, 1506.

Cassville Slough, '80, 1506.

Keithsburgh Bar, '80, 1506.

Vicinity of Dubuque, '80, 1532.

Vicinity of Muscatine, '80, 1540.

Vicinity of Fort Madison, '80, 1540.

Vicinity of Burlington, '81, 1540.

Vicinity of Wabasha, '86, 1418.

Vicinity of Boulanger Slough, '86, 1420.

MISSISSIPPI RIVER AT DES MOINES RAPIDS. (See Des Moines Rapids.)

MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER (EXCEPT OPERATIONS OF SNAG-BOATS).

Appropriations.

For appropriations prior to 1880, see Index, Vol. 1, page 317.

1880, from Des Moines Rapids to mouth of Illinois River.... \$100,000, '80, 1514.

1881, from Des Moines Rapids to mouth of Illinois River.... 175,000, '81, 1696.

MISSISSIPPI RIVER—Continued.

Appropriations—Continued.

1882, from Des Moines Rapids to mouth of Illinois River....	\$200,000, '82, 1767.
1884, from Des Moines Rapids to mouth of Illinois River....	200,000, '84, 1563.
1886, from Des Moines Rapids to mouth of Illinois River....	150,000, '86, 2855.
1880, Alexandria Harbor, Mo.	10,000, '80, 1543.
1881, Alexandria Harbor, Mo.	6,000, '81, 1716.
1880, Quincy Harbor, Ill.	25,000, '80, 1545.
1881, Quincy Bay, Ill.	10,000, '81, 1719.
1882, Quincy Bay, Ill.	15,000, '82, 1788.
1880, Hannibal, Mo.	25,000, '80, 1546.
1881, Hannibal, Mo.	20,000, '81, 1720.
1881, Louisiana, Mo.	10,000, '81, 1723.
1888.	200,000, act of August 11, 1888.

Contracts.

1879. S. Sample, for shore protection and dams at Canton, '80, 1508, 1514. Whitney & Sons, dredging at Quincy, for 15 $\frac{1}{4}$ cents per cubic yard, and dam construction, '80, 1545.
1880. Whitney & Son, for shore protection and dams above Gregory's Landing, '81, 1698. C. M. Cole, for dam construction and shore protection at Denmark Island and Westport Chute, '81, 1698, 1699. W. A. & J. C. Patterson, for dam construction and shore protection at Alexandria, Mo., '81, 1716. H. S. Brown, for dredging at Quincy, at 18 and 20 cents per cubic yard, '81, 1718. H. S. Brown, for dam construction, shore protection, and dredging at Hannibal, '81, 1721.
1881. W. A. & J. C. Patterson, for dam construction at Alexandria Harbor, Mo., '82, 1786. H. S. Brown, for dredging at Quincy, at 20 and 23 cents per cubic yard, '81, 1718. W. A. & J. C. Patterson, for dam construction at Louisiana, '81, 1723.
1882. Patterson Brothers, for shore protection and dams near Louisiana, '83, 1400. H. S. Brown, for brush and stone revetment below Quincy, '83, 1400.
1884. H. S. Brown, dredging in Quincy Bay, at 14 cents per cubic yard, '85, 1687. Patterson Brothers, for shore protection and dams near Louisiana, '85, 1685, 1687; '86, 2853.
1885. H. S. Brown, for dredging in Quincy Bay, at 14 cents per cubic yard, '86, 2854.
1886. H. S. Brown, for shore protection and dams, '87, 1610.
1887. Patterson Brothers, for shore protection and dams, '87, 1610. E. M. Morton and others, for tow-boat, '87, 1612. J. Spect, for centrifugal pump, '87, 1612. M. Von Hein, for flat-boats, '87, 1613.

Engineers.**CHIEF OF ENGINEERS.**

- From Des Moines Rapids to mouth of Illinois River. Reports, '80, 172; '81, 222; '82, 227; '83, 236; '84, 239; '85, 261; '86, 249, 251; '87, 217.
- Alexandria Harbor, Ind. Reports, '80, 175; '81, 235; '82, 233; '83, 240.
- Quincy, Ill. Reports, '80, 175; '81, 235, 236; '82, 233, 234; '83, 241; '84, 243; '85, 265, 266, 1717.
- Hannibal, Mo. Reports, '80, 175; '81, 236; '82, 234; '83, 241.
- Louisiana, Mo. Reports, '80, 177; '81, 237; '82, 234; '83, 242.

BOARD OF ENGINEERS.

- Mississippi River Commission. Reports, '81, 2742, 2755; '85, 2539; '86, 2143; '87, 2690.

ENGINEERS IN CHARGE.

- Maj. A. Mackenzie, 1880-'84:
From Des Moines Rapids to mouth of Illinois River. Reports, '80, 1506, 1514, 1526; '81, 1696, 2755; '82, 1763; '83, 1395; '84, 1560; '85, 1685.
Transferred to Mississippi River Commission, Sept. 1, 1884. Reports, '85, 261, 2539; '86, 2143; '87, 2690. Transferred to Engineer Department by act of August 5, 1886, '86, 459.
- Capt. E. H. Ruffner. Reports, '85, 2851, 2960, 2935; '86, 2154; '87, 1607, 2719.
- Alexandria Harbor, Mo. Reports, '80, 1543; '81, 1715; '82, 1786; '83, 1424.
- Quincy Harbor and Bay, Ill. Reports, '80, 1543; '81, 1717; '82, 1786; '83, 1424, 1425; '84, 1588, 1590; '85, 1709, 1717.
- Hannibal, Mo. Reports, '80, 1546; '81, 1719; '82, 1789; '83, 1428.
- Louisiana, Mo. Reports, '81, 1723, 1724; '82, 1790; '83, 1428.

ASSISTANTS.

- O. N. Caffee. Reports, '81, 1699, 1717, 1721; '83, 1401; '84, 1568, 1590.
- C. W. Durham. Reports, '82, 1788; '83, 1402, 1426; '84, 1563.
- E. F. Hoffman. Report, '84, 1565.
- M. Meigs. Report, '84, 1568.

MISSISSIPPI RIVER—Continued.**Operations.**

- 1879-'80. Construction of brush and stone dams and shore protection at Canton, Gilbert's Island, and Slim Island; dredging at Hannibal and below Cincinnati Landing, '80, 1506-1513. At Quincy Harbor, 1,800 feet of spur-dams built and 48,900 cubic yards dredged from Quincy Bay, '80, 1544-1545.
- 1880-'81. Construction of brush and stone dams and shore protection at Gilbert's and Denmark islands, Gregory's Landing, and Westport Chute, '81, 1696-1699. 8,417 cubic yards brush and stone placed in wing-dams at Alexandria, '81, 1717. At Quincy Dam, closing square chutes commenced and 15,305 cubic yards dredged from Quincy Bay, '81, 1717, 1718. At Hannibal, 54,000 cubic yards dredged from bar, and the construction of dam at Glasscox Island, '81, 1719. At Louisiana, spur-dam opposite steam-boat landing commenced, '81, 237.
- 1881-'82. Construction of brush and stone dams and shore protection at Gilbert's and Denmark islands, Gregory's Landing, Canton and Smoot's chutes; construction of dredge and dumps in progress; operations at Dixon Quarry, '82, 1763-1766. 3,785 cubic yards brush and stone placed in wing-dams at Alexandria, '82, 1786. Project completed, '83, 1426. At Hannibal, 49,712 cubic yards dredged from bar and lower wing-dam completed, '82, 234. At Louisiana, spur-dam completed to length of 1,000 feet, '82, 1791.
- 1882-'83. Construction of brush and stone dams and shore protection at Gregory's Landing, Quincy, Hannibal, Louisiana, Cap au Gris, Boester's and Dardenne islands; progress on dredge and dump boats; operations at Dixon Quarry, '83, 1396-1403. At Quincy Bay, 63,677 cubic yards dredged, '83, 1426.
- 1883-'84. Construction of brush and stone dams and shore protection at Louisiana, Quincy, Gilbert's Island, Alexandria, Marion City, Hannibal, Canton, Denmark Island, and Dardenne Island; dredging at Howard's (Smoot's) Crossing, and above Mundy's Landing; completion of dredge and dumps, '84, 1560-1570. At Quincy, wing-dams built in 1879 strengthened, and protection placed at head of Island 427, '84, 1589.
- 1884-'85. Works transferred to Mississippi River Commission September 1, 1884, '85, 261. Construction of brush and stone dams and shore protection at Louisiana, Quincy, Brokau Island, Canton, and La Grange and Bolton Island, '85, 1686, 2539, 2935.
- 1885-'86. Repair of dams at Carroll's, Coon, and Slim islands; new dams commenced at Westport Chute; North and South Fritz Islands; dredging at Quincy Bay, Hickory Chute, and Wyaconda Bar, '86, 2143, 2154-2156, 2351, 2853. Comparative cost of brush and stone pier from 1872 to 1885, '85, 1405. Comparative cost of dredging from 1878 to 1885, '86, 1407. Repair of closing dams at Denmark, Carroll's, Hickory, and Slim islands; construction of dams at Westport Chute and Fritz Islands; completing revetment at Cincinnati Landing; dredging at Quincy Bay, Hickory Chute, and Wyaconda; minor repairs and work on shore protection, '87, 2691, 2719.
- 1886-'87. Dredging at mouth of Hamburg Bay; dam construction at Oyster Island, Islands 500 and 501, Gilbert's Island, Cincinnati Chute, and Turner's Island; construction and operation of hydraulic dredge, '87, 1608-1612.

Physical Characteristics.

- Low-water line, '80, 1518.
 Discharge of river, '80, 1518.
 List of bench-marks, '80, 1520.
 Drainage area of tributaries, '80, 1522.
 Sediment obstructions, '80, 1531.

Projects.

- The general project for the improvement of the river between Des Moines Rapids and the mouth of the Illinois River, a distance of 161 miles, is the closure of side channels by low dams, usually of brush and stone; the contraction of the width of the river, where excessive, by spur-dikes of brush and stone, and the protection of banks subject to erosion, by brush mattress, covered with stone; the object sought is a low-water depth of about 5 feet, '81, 2745; '85, 2539; '87, 217.
- At Alexandria Harbor, Mo., the project of 1879 proposed the improvement to a depth of 5 feet at low water of Warsaw Crossing Bar by the construction of wing-dams. Estimated cost, \$30,945.75, '79, 1150; '83, 240. Improvement accomplished in 1883 by the expenditure of \$16,000, '83, 1424.
- At Quincy Harbor and Bay the project of 1879 proposed the improvement of the bar in front of the city landing by 3 spur-dikes and 1 closing-dam from right bank, and the improvement of Quincy for use as an ice-harbor, and to accommodate commerce by dredging to a depth of 6 feet. Estimated cost, \$224,110, '79, 1130, 1131; '80, 1543.

MISSISSIPPI RIVER—Continued.**Projects—Continued.**

The project for the improvement of the river at Hannibal, Mo., was adopted in 1880 and proposed the removal of the bar in front of the city by dredging, and the prevention of its re-formation by spur-dikes from the Illinois shore. Estimated cost, \$60,000, '80, 1547.

By Maj. Mackenzie, 1880, for the improvement of the river in the vicinity of Louisiana, Mo., so as to afford 6 feet at low water, by the construction of a spur-dike from the Illinois shore opposite Louisiana, the removal of rocks from the channel below the bridge, the closing of Buffalo Island and Broken Chutes; the construction of a spur-dike from the Illinois shore below the bridge and the shore protection of Buffalo Island. Estimated cost, \$55,000, '81, 1723, 1726.

Surveys.

From Saint Paul to mouth of Illinois River, '80, 1514.

Between Burlington and Montrose, Iowa, '80, 1526.

At Quincy, Ill., '85, 266.

At Louisiana, '81, 1724.

Maps.

Canton Bar, '80, 1512.

Hannibal Harbor, '80, 1512.

Gilbert's Island, '80, 1512.

Slim Island Bar, '80, 1512.

Gregory Landing, '83, 1396.

Vicinity of Louisiana, '84, 1564.

Quincy Harbor and Bay, '80, 1544; '83, 1425.

MISSISSIPPI RIVER AT ROCK ISLAND RAPIDS. (See ROCK ISLAND RAPIDS.)

MISSISSIPPI RIVER BETWEEN THE MOUTHS OF THE ILLINOIS AND OHIO RIVERS. (EXCEPT ICE-HARBOR AT SAINT LOUIS.)

Appropriations.

For appropriations previous to 1880, see Index, Vol. I, p. 317.

1880..... \$250,000, '80, 1377.

1881..... 600,000, '81, 1537.

1882..... 600,000, '82, 1606.

1884..... 520,000, '84, 1417.

1886..... 375,000, '86, 249.

1888..... 300,000, act of August 11, 1888.

1881. Alton Harbor, Ill. By act of March 3, 1879, the unexpended balance of \$33,354.70 from the appropriation for improving Mississippi River between the Illinois and Missouri rivers was reappropriated for Alton Harbor, '81, 1573.

1880. Cape Girardeau, Mo., \$20,000, '80, 1391.

1881. Cape Girardeau, Mo., 10,000, '81, 1586.

Commerce.

Amount of commerce to be benefited by the improvement, '80, 1376.

Draught of boats on Upper Mississippi River, '81, 2755.

Contracts.

Disadvantages of the contract system, '80, 1374.

1886. D. Kerwin, for screw bolts; H. L. Fox & Co., for spike iron and nails; Broderick & Bascom, for rope; J. Cleary for piles, '87, 1577, 1578.

Encroachments.

Col. Simpson did not consider that riparian owners at Venice, Ill., had sustained damage from works already built by United States, '80, 1397.

Engineers.**CHIEF OF ENGINEERS.**

Between the mouths of the Illinois and Ohio rivers. Reports, '80, 159, 161; '81, 220, 1569; '82, 217; '83, 224; '84, 232; '85, 259; '86, 249; '87, 212.

Alton Harbor, Ill. Reports, '80, 161; '81, 221; '82, 219; '83, 227; '84, 234.

Cape Girardeau, Mo. Reports, '80, 161; '81, 222; '82, 220; '83, 228; '84, 235.

MISSISSIPPI RIVER—Continued.**Engineers—Continued.****BOARD OF ENGINEERS.**

Constituted by S. O. No. 144, C. of E., 1880, to examine and report upon Capt. Ernst's plan for the improvement of the river near Piassa Island. Report, '31, 1569-1571. (Majs. Comstock and Suter, and Capt. Mackenzie.)

Mississippi River Commission. Reports, '81, 2742, 2755; '82, 2762, 2780; '83, 2226; '85, 2539, 2661; '86, 2143; '87, 2691.

ENGINEERS IN CHARGE.

Between mouths of the Illinois and Ohio rivers:

Col. J. H. Simpeon, 1873-'80. Report, '80, 159.

Maj. O. H. Ernst, 18-'86. Reports, '80, 1359, 1361; '81, 1519, 1566, 1571, 1594; '82, 1591, 1670; '83, 1177, 1288; '84, 1411, 1527; '85, 1655, 2339, 2855, 2939; '86, 2156; '87, 2722.

Transferred to Mississippi River Commission, '85, 259, 2555. Reports, '85, 2539, 2661; '86, 2143; '87, 2691.

Maj. A. M. Miller, 1886-'—. Report, '87, 1566.

Alton Harbor, Ill:

Maj. O. H. Ernst. Reports, '80, 1398; '81, 1573; '82, 1644; '83, 1183, 1239, 1238; '84, 1527.

Cape Girardeau, Mo:

Maj. O. H. Ernst. Reports, '80, 1391; '81, 1585; '82, 1649; '83, 1291; '84, 1529.

ASSISTANTS.

D. M. Currie. Reports, '80, 1379; '81, 1546; '82, 1607; '83, 1193; '84, 1442.

C. S. True. Report, '80, 1387.

M. E. Schmidt. Report, '81, 1559.

W. S. Mitchell. Reports, '81, 1563; '82, 1626; '83, 1216; '84, 1488.

C. F. West. Report, '81, 1565.

A. F. Fries. Report, '82, 1620, 1622.

C. V. Mercereau. Reports, '82, 1629; '83, 1230; '84, 1495.

J. R. Record. Report, '82, 1633.

O. Hollman. Reports, '82, 1635; '83, 1223, 1232; '84, 1497, 1527.

C. D. Lamb. Reports, '82, 1645; '83, 1201, 1238, 1239, 1290; '84, 1493.

E. D. Libby. Reports, '83, 1201; '84, 1483.

J. E. Savage. Reports, '83, 1226; '84, 1486, 1496.

Lieut. F. V. Abbot. Reports, '83, 1236, 1249; '84, 1505.

E. H. Johnson. Report, '84, 1492.

G. Bagnall. Report, '82, 1644.

J. A. Worthen. Reports, '82, 1651; '83, 1291.

Legal Proceedings.

Riparian rights, '80, 1370, 1397.

Damages caused by works of improvement, '80, 1373; '81, 1526.

Operations.

1879-'80. At Saint Louis, closing of breach and repairs to dam at Cahokia Chute, '80, 1361, 1379. At Horsetail Bar, construction of 2,500 feet of training-wall and 3,200 feet of hurdles, '80, 1365, 1379, 1384. At Kaskaskia Bend, bank protection extended 1,100 feet and mattresses placed along 3,305 feet of the foot of the slope, '80, 1366, 1389. At the Cairo Protection the revetment was extended upstream 2,900 feet and raised to height of 20 feet above low water for its whole length, '80, 1367, 1387.

1880-'81. At Horsetail Bar, 9,500 feet of primary and 22,000 of secondary hurdles constructed, together with repairs to previous works, '81, 1521, 1546-1552. At Kaskaskia Bend repairs were made at breaches, 1,140 feet of hurdle-dike built from the lower end of Saint Genevieve Island, and 1,005 feet of shore protection strengthened, '81, 1524, 1559-1563. At Cape Girardeau, preparations for construction of hurdle-dikes, '81, 1585. At Cairo Protection repairs were made to the revetment, '81, 1527, 1543, Plate 17, page 1598.

1881-'82. At Alton Harbor partial construction of 2,040 feet of dike above head of Ashton Chute, '82, 1644, 1646. At Saint Louis the Arsenal Island revetment was completed over a distance of 3,500 feet and the revetment extended down-stream for an additional distance of 2,750 feet, '82, 1593, 1608, 1620. At Horsetail Bar 16,914 feet of hurdle-dike was built, '82, 1594, 1609, 1622. At Carroll's Island 1,695 feet of shore revetment was placed on west side of island, '82, 1596, 1612, 1629, 1654, Plate 10. At Twin Hollows 8,800 feet of primary hurdles were placed on the west side and 6,618 feet of shore protection on the east side of the river, '82, 1597, 1598, 1611, 1612, 1626, 1631. At Beard's Island 3,550 feet of shore protection placed and a hurdle 1,000 feet long placed across chute north of island, '82, 1599, 1615, 1633. At Jim Smith's 1,000 feet of hurdle-dike built, '82, 1600, 1616, 1635. At Cape Girardeau partial construction of hurdle-dikes, '82, 1650, 1662, Plate 20. General considerations relating to constructions, '82, 1601.

MISSISSIPPI RIVER—Continued.

Operations—Continued.

1882-'83. At Alton Harbor dike extended to length of 4,800 feet; action of dike highly satisfactory, '83, 1183, 1184, 1239. At Saint Louis the Arsenal Island revetment was in progress over 3,253 feet of its length; at the dam closing Cahokia Chute 2 hurdle-dikes were built, '83, 1178, 1193, 1211, 1288, 1296, Plate 1. At Horsetail 2,450 feet of hurdle-dike connecting Carroll's Island with its Illinois shore, '83, 1179, 1194, 1212, 1296, Plate 2. At Twin Hollows hurdle-dike construction was continued on the west bank and shore protection on the east bank, '83, 1179, 1180, 1196, 1198, 1216, 1223, 1296, Plate 4. At Pulltight 2,860 feet of primary hurdles was constructed and 2 secondary hurdles commenced, '83, 1180, 1200, 1244. At Beard's Island the shore protection was extended 3,850 feet, '83, 1180, 1201, 1226, 1296, Plate 5. At Chesley Island 4,305 feet of shore protection was placed on the east side of the island, 550 feet at the head of the island, and 900 feet of hurdle-dike built, closing the chute west of the island, '83, 1181, 1202, 1230, 1296, Plates 3 and 6. At Jim Smith's 7,650 feet of primary hurdles was built, '83, 1182, 1204, 1232. At Foster's Island 580 feet of shore protection was placed on the west side of the island, '83, 1182, 1236. At Piassa Island 385 feet of old dam was removed from the dam across the south chute, '83, 1183, 1238. At Cape Girardeau completion of hurdle-dike to length of 3,100 feet, '83, 1291.

1883-'84. At Saint Louis the two hurdles across Cahokia Chute were completed, '84, 1443, 1527, 1526, Plate 5. At Horsetail, minor repairs to hurdles, construction of 2,775 feet of secondary hurdles, and 3,880 feet of shore protection on west side of river, '84, 1413, 1443, 1483, 1486, 1562, Plates 1 and 5. At Twin Hollows, minor repairs to hurdles and construction of one secondary hurdle on west bank and on east bank extension in height of former shore protection, '84, 1413, 1445, 1488, 1492, 1526, Plate 2. At Pulltight, repairs to primary hurdles, reconstruction of one and building of two additional secondary hurdles, '84, 1414, 1446, 1493, 1526, Plate 2. At Chesley Island, completion of hurdle closing west chute and its subsequent injury; bank protection placed on east side, '84, 1414, 1447, 1495, 1526, Plate 2. At Jim Smith's, partial reconstruction of hurdles previously built, '84, 1414, 1447, 1498, 1526, Plate 2. Observations on pile-driving, '84, 1416, 1505. Repairs to plant, '84, 1502. Work transferred to Mississippi River Commission, '85, 289, 2855.

1884-'85. At Alton the dike opposite and above the landing was completed to the height of 14 feet above low water for a distance of 4,000 feet, '85, 2855, 2939. At Saint Louis, 1,283 feet of bank protection placed at Arsenal Island and 1,035 feet brought to the top of the bank; minor repairs made to the Cahokia Chute hurdles, '85, 2855, 2939, 1656, Plate 1. At Horsetail, 1,150 feet of bank protection placed on west side and 2,140 feet of bank protection carried to height of from 16 to 21 feet above low water; on east side additional hurdles were placed, '85, 2855, 2939. At Twin Hollows repairs were made to the hurdles on the west side and additional hurdles constructed, 2,825 feet of bank protection placed on east side of river, '85, 2856, 2940. At Pulltight, Hurdles Nos. 3, 4, and 5 were in progress of construction, '85, 2856, 2940. At Jim Smith's, hurdle construction in progress, '85, 2856, 2940. At Cairo Protection, 4,563 feet of bank protection placed, '85, 2857.

1885-'86. At Carroll's Island the hurdle was extended 2,200 feet and breaks in former hurdle repaired, '86, 2157. At Twin Hollows 570 feet of bank protection was placed and riprap deposited upon the bank at various points, '86, 2157. At Pulltight the primary hurdles and one of the secondary were raised to the height of 16 feet above low water, '86, 2157. At Chesley Island 670 feet of hurdle was placed, '86, 2157. At Jim Smith's, 11,205 linear feet of hurdles raised to height of 16 feet above low water, '86, 2157. At Cairo Protection a part of the bank was graded and covered with riprap, '86, 2158. Repairs and extensions at Horsetail, Twin Hollows, Pulltight, Chesley Islands, and Jim Smith's, '87, 2691, 2722.

1886-'87. At Piassa Island, sand-bar removed from channel; at Horsetail and Carroll's islands, repair to hurdle closing east chute; at Twin Hollows, bank revetment placed; at Chesley Island, closure of gap in hurdle at west chute; at Jim Smith's, wattling raised to 16 feet above high water; at Sulphur Springs, construction of hurdle dike; at Cairo, bank protection, '87, 212, 1557-1566.

Physical Characteristics.

Stability of wooded banks, '80, 1368, 1369.

Bank erosion, '80, 1369; '81, 1524; '82, 1599.

Volume of river deposits at Horsetail Bar, '80, 1521.

Navigable depth between Saint Louis and Cairo, '81, 1530, 1542; '82, 1640; '83, 1284; '84, 1416, 1522; '87, 1580.

MISSISSIPPI RIVER—Continued.**Physical Characteristics—Continued.**

Standard low water, '81, 1531.

Low-water discharge, '81, 1533; '82, 2762.

Gauge records, '80, 1539; '82, 1638; '83, 1282; '84, 1521; '87, 1579.

High-water stages, '82, 1618.

Amount of sediment in suspension, '82, 2762.

Slope of river, '82, 2763.

Projects.

The object of the improvement of the river from the mouth of the Illinois River to the mouth of the Ohio River, a distance of 241 miles, is to obtain a minimum depth at standard low water of 6 feet from the mouth of the Illinois River to Saint Louis, a distance of about 54 miles, and from thence to the mouth of the Ohio, a distance of about 187 miles, a low-water depth of 8 feet.

The general plan contemplates making the improvement continuous, beginning at Saint Louis and working down-stream, by reducing the river to an approximately uniform width of 2,500 feet.

The methods employed are silt-arresting devices, whereby the solid material caught from the river is deposited so as to form new shore-lines, which, together with the natural banks of the river, are protected where necessary from caving and erosion by a revetment of brush and stone. The estimated cost of the project was \$16,997,100, '81, 2745; '82, 2763; '83, 1187; '84, 1417; '85, 2861; '87, 213, 1556, 1569.

At Alton Harbor, Ill., the project of 1871 proposed closing the chute behind Ellis Island with a brush and stone dam, '71, 318, 320; '72, 361; '73, 443.

Dam completed to height of 10 feet above low water in 1874, '75, i, 447.

In 1881 Maj. Ernst proposed the removal of the shoal in front of Alton Landing by the construction of a deflecting dike from the Missouri shore and above the head of Ellis Island. Estimated cost, \$120,000, '81, 1573; '82, 1644.

At Cape Girardeau, Mo., Maj. Ernst proposed, in 1881, the formation of an 8-foot channel between Cape Girardeau and Minton's Point by the construction of hurdle-dikes from the end of Devil's Island, near Minton's Point, and from the Illinois shore opposite Cape Girardeau. Estimated cost, \$90,170.16, '81, 1598; '82, 1650. Plate xx, page 1654.

Surveys.

At Saint Genevieve, Mo., '80, 1594.

Opposite mouth of Missouri, '80, 1400.

In vicinity of Piassa Island, '81, 1566.

At Fish Bend, near Fort Chartres, '82, 1670.

In the vicinity of Venice, '80, 1396.

1873-'80, '80, 1368.

18-'81, '81, 1529, 1565, 1566.

1881-'82, '82, 1604.

Mars.

At Alton Harbor, '82, 1654.

At Saint Louis, '82, 1654; '83, 1296; '84, 1256; '85, 1656.

At Horsetail Bar, '81, 1598; '82, 1654; '83, 1296; '84, 1526; '85, 1656.

From Carroll's Island to Meramec River, '81, 1598.

At Kaskaskia Bend, '81, 1598.

Near Saint Genevieve, Mo., '81, 1598.

At Cape Girardeau, '81, 1598.

Near Piassa Island, '81, 1598.

From Saint Louis to Foster Island, '82, 1654.

At Arsenal Island, '82, 1654; '83, 1296.

From Carroll's to Chesley Island, '82, 1654; '83, 1296; '84, 1526; '85, 1656.

At Carroll's Island, '82, 1654.

At Twin Hollows, '82, 1654; '83, 1296.

At Beards' Island, '82, 1654; '83, 1296.

At Cape Girardeau, '81, 1598; '82, 1654.

At Chesley Island, '83, 1296.

MISSISSIPPI RIVER, UPPER—REMOVAL OF SNAGS AND OBSTRUCTIONS.**Appropriations.**

1880.....	\$8,000, '80, 1482.
1881.....	25,000, '81, 1681.

MISSISSIPPI RIVER, UPPER—Continued.**Appropriations—Continued.**

1882.....	\$25,000, '82, 1751.
1884.....	15,000, '84, 1547; '85, 265.
1886.....	22,500, '86, 1405.

Total 95,500

1888..... 25,000, act of August 11, 1888.

List of appropriations from 1867 to 1886, '86, 1404; '87, 1619.

Commerce.

Statement of commerce on upper river, '80, 1492.

Vessel accidents in 1879, '80, 1492.

Advantages to commerce from use of sheer booms at bridges, '81, 1678.

Necessity for lights and dams, '81, 1679.

Necessity for ice-harbors, '81, 1680.

List of wrecks, '84, 1548.

Contracts.

1881. Howard & Co., for construction of light-draught snag-boat, '82, 1752.

Encroachments.

Injurious effect of sawdust deposits in upper river, '81, 1679; '82, 1750.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 171; '81, 231; '82, 228; '83, 235; '84, 238; '85, 260, 265; '86, 250; '87, 218.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1880.— Reports, '80, 1481; '81, 1677; '82, 1750; '83, 1377; '84, 1245; '85, 1662; '86, 1403; '87, 1617, 1623.

ASSISTANT.

C. W. Durham. Reports, '80, 1482; '81, 1681; '82, 1751; '83, 1379; '84, 1547; '85, 1663; '87, 1620.

Operations.

Removing obstructions between Saint Paul and mouth of Mississippi River:

1879-'80. Summary of operations, '80, 1483.

1880-'81. Summary of operations, '81, 1681.

1881-'82. Summary of operations, '82, 1751.

1882-'83. Summary of operations, '83, 1380.

1883-'84. Summary of operations, '84, 1548.

1884-'85. Summary of operations, '85, 1644.

1885-'86. Summary of operations, '86, 1409.

1886-'87. Summary of operations, '87, 1620.

Summary of operations from 1863 to 1884, '85, 1664.

Comparative cost of construction material from 1878 to 1885, '86, 1405, 1407.

Comparative cost of dredging from 1882 to 1885, '86, 1408.

Physical Characteristics.

List of bars and channel depths, '80, 1484; '81, 1682; '82, 1752.

MISSISSIPPI RIVER, LOWER—REMOVING SNAGS AND WRECKS FROM.

(Continued from Vol. I, p. 576.)

Appropriations.

1880, Mississippi, Missouri, and Arkansas rivers. \$200,000, '80, 1404.

1881, Mississippi River..... 80,000, '81, 1600.

1882, Mississippi River..... 85,000, '82, 1675.

1884, Mississippi River..... 175,000, '84, 1532.

1886, Mississippi River..... 56,250, '86, 1394.

Total 496,250

1888..... 100,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 162; '81, 223; '82, 221; '83, 229; '84, 236; '85, 252; '86, 244; '87, 210.

*An allotment for continuing work above mouth of Missouri River, '84, 1547; '85, 265.

†Stated in reports as \$63,000. See '84, 1547; '85, 265.

MISSISSIPPI RIVER, LOWER—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. C. R. Suter, 1873-'84. Reports, '80, 1401; '81, 1599; '82, 1674; '83, 1297; '84, 1531; '85, 1652.

Maj. A. M. Miller, 1884-'—. Reports, '85, 1633; '86, 1393; '87, 1553.

Operations.

All operations by hired labor.

1879-'80. 1,522 snags, 19 drift piles, and 600 trees removed, '80, 1402. Construction of new snag-boats in progress, '80, 1403.

1880-'81. 1,057 snags, 6 drift piles, and 647 trees removed, '81, 1600. Completion of new snag-boats, '81, 1602.

1881-'82. 1,909 snags, 32 drift piles, and 4,983 trees removed, '82, 1574.

1882-'83. 2,775 snags, 31 drift piles, and 26,297 trees removed, '83, 1298.

1883-'84. 958 snags, 3 drift piles, and 4 trees removed, '84, 1532.

1884-'85. 1,692 snags and 16,900 trees removed, '85, 1634.

1885-'86. 693 snags and 567 trees removed, '86, 1394.

1886-'87. 2,030 snags, 10 drift piles, and 5,269 trees removed, '87, 1554.

MISSISSIPPI RIVER—BETWEEN THE MOUTH OF THE OHIO RIVER AND THE HEAD OF THE PASSES.

(Including Memphis, Vicksburg, Natchez, Vidalia, and New Orleans harbors, and improvement of the mouth of the Red River.)

Appropriations.

1874-'79		\$352,000
1879	Survey and expenses of Commission	175,000
1880	Survey and expenses of Commission	150,000, '80, 228.
	Memphis Harbor	15,000, '80, 1338.
	Vicksburg Harbor	20,000, '80, 1334.
	Natchez and Vidalia harbors	40,000, '80, 1333.
	New Orleans Harbor	75,000, '80, 1151.
1881	Surveys and expenses of Commission	150,000, '83, 2116.
	Mississippi River from Cairo to Head of Passes	1,000,000, '82, 2753.
	Memphis Harbor	15,000, '81, 1382.
	Vicksburg Harbor	75,000, '81, 1385.
	Natchez and Vidalia harbors	50,000, '81, 1387.
1882	New Orleans Harbor	75,000, '81, 1275.
	Surveys and expenses of Commission	150,000, '83, 2113.
	Mississippi River from Cairo to Head of Passes	4,123,000, '83, 2119.
	Survey and expenses of Commission	150,000, '84, 2429.
	Survey and expenses of Commission	150,000, '85, 2563.
1884	Mississippi River from Cairo to Head of Passes	2,350,000, '84, 373, 404.
	Surveys	30,000, '86, 460.
	Mississippi River from Cairo to Head of Passes	2,000,000, '86, 460.
Total		11,145,000
1888	From Ohio River to Head of the Passes	2,000,000, act of August 11, 1888.
	Special localities	845,000, act of August 11, 1888.
	Survey from headwaters to Passes	75,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Memphis Harbor, Tenn. Reports, '80, 157; '81, 204; '82, 201.

Vicksburg Harbor, Miss. Reports, '80, 157; '81, 205; '82, 205.

Natchez, Miss., and Vidalia, La. Reports, '80, 157, 158; '81, 205; '82, 202.

Mouth of Red River, La. Reports, '80, 151; '81, 205; '82, 203.

New Orleans Harbor, La. Reports, '80, 141; '81, 190; '82, 187, 1357, 1359.

BOARD OF ENGINEERS.

Convened April, 1880, to consider plans for the permanent improvement of the mouth of the Red River. Report, '80, 1284. (Cols. Tower and Newton and Maj. Abbot.)

MISSISSIPPI RIVER—Continued.**Engineers—Continued.****BOARD OF ENGINEERS—Continued.**

Constituted by S. O. No. 97, C. of E., 1881, to examine and report upon the condition of the work in progress for the protection of the city front of New Orleans. Report, '82, 1359, 1366. (Majs. Suter, Benyaure, and Stickney, and Capt. Ernst.)

Mississippi River Commission. Reports, '81, 2720, 2740; '82, 2745; '83, 2111; '84, 2408; '85, 2535, 2559; '86, 2143; '87, 2689, 2749, 2764. (Col. Gillmore, Lieut. Col. Comstock, Maj. Suter, U. S. Corps of Engineers, and Messrs. Henry Mitchell, B. M. Harrod, B. Franklin, J. B. Eads, R. S. Taylor, and S. W. Ferguson.)

Supplemental reports of members of the Commission:

Lieut. Col. Comstock and B. Harrison, '81, 2739.

J. B. Eads, '81, 2764.

Lieut. Col. Comstock, '84, 2431; '85, 2874, 2877; '87, 2766.

Col. Gillmore, '85, 2871.

B. M. Harrod, '85, 2880.

H. Mitchell, '85, 2565; '87, 2767.

Special reports:

G. Little, '83, 2315.

F. L. James, '83, 2339.

Profs. Hilgrade and Hopkins, '84, 2885.

H. Mitchell, '83, 2300, 2302, 2373.

H. L. Marindin, '83, 2308.

ENGINEERS IN CHARGE.**Memphis Harbor:**

Maj. W. H. H. Benyaure, 1877-'82. Reports, '80, 1337; '81, 1381; '82, 1498.

Transferred to Mississippi River Commission.

Vicksburg Harbor:

Maj. W. H. H. Benyaure, 1878-'82. Reports, '80, 1333; '81, 1384; '82, 1502.

Transferred to Mississippi River Commission.

Natchez and Vidalia harbors:

Maj. W. H. H. Benyaure, 1880-'82. Reports, '80, 1332; '81, 1386; '82, 1503.

Transferred to Mississippi River Commission.

Mouth of Red River, La.:

Maj. W. H. H. Benyaure, 1878-'82. Reports, '80, 1282, 1288; '81, 1389; '82, 1511, 1515. Transferred to Mississippi River Commission.

New Orleans Harbor:

Maj. C. W. Howell, 1878-'81. Reports, '80, 1145; '81, 1271.

Maj. A. Stickney, 1881-'82. Report, '82, 1354. Transferred to Mississippi River Commission.

Mississippi River from mouth of the Ohio to Head of Passes, under direction of Mississippi River Commission:

Maj. A. Stickney. Reports, '83, 2297; '84, 2868; '85, 2815, 2824, 2897; '86, 2164.

Maj. A. M. Miller. Reports, '83, 2282; '84, 2297.

Capt. C. B. Sears. Reports, '83, 2274; '84, 2692; '85, 2772, 2784, 2960; '86, 2162.

Capt. T. Turtle. Reports, '85, 2887; '86, 2153; '87, 2607-2710.

Capt. J. G. D. Knight. Reports, '83, 2278; '84, 2755; '85, 2741.

Capt. W. L. Marshall. Reports, '83, 2285; '84, 2314.

Capt. J. H. Willard. Reports, '85, 2724, 2923; '86, 2147.

Capt. S. S. Leach. Reports, '83, 2156, 2209, 2226; '84, 2441; '85, 2573, 2942, 2955; '86, 2158, 2161; '87, 2724, 2731, 2769, 2873, 2878.

Capt. E. H. Ruffner. Report, '87, 2719.

Capt. W. T. Russell. Report, '87, 2736, 2881.

Maj. C. W. Raymond. Report, '87, 2744.

Lieut. J. L. Lusk. Report, '87, 2864.

Capt. D. C. Kingman. Report, '87, 2893.

ASSISTANTS.

G. Y. Wisner. Report, '83, 2172.

J. B. Johnson. Reports, '83, 2174; '84, 2456; '85, 2575, 2609.

A. Hider. Reports, '83, 2191; '84, 2828; '85, 2789; 2966; '87, 2739.

J. A. Ockerson. Reports, '83, 2266; '84, 2568, 2687; '85, 2681, 2898.

H. St. L. Coppee. Reports, '82, 1531; '83, 2294; '84, 2844; '85, 2812.

J. A. Paige. Report, '84, 2454.

L. L. Wheeler. Reports, '84, 2463, 2547, 2576; '85, 2689, 2900; '87, 2815, 2835, 2846, 2856.

C. M. Winchell. Reports, '84, 2573; '85, 2687, 2893.

MISSISSIPPI RIVER—Continued.**Engineers—Continued.****ASSISTANTS—Continued.**

H. B. Wood. Report, '84, 2577.
 F. S. Davis. Report, '84, 2580.
 W. G. Price. Reports, '84, 2584, 2875; '85, 2845, 2987; '87, 2905.
 J. H. Davis. Report, '84, 2600, 2616, 2664.
 J. Ewens. Reports, '84, 2636, 2660; '85, 2636.
 H. P. Ritter. Report, '84, 2661.
 A. J. Firth. Reports, '84, 2764; '85, 2748.
 G. W. Gender. Reports, '84, 2768; '85, 2751.
 C. D. Mark. Report, '84, 2772.
 A. J. Nolt. Reports, '84, 2776; '85, 2761, 2949.
 F. A. Yeager. Reports, '84, 2779; '85, 2768.
 A. P. Hatfield. Reports, '84, 2780; '85, 2764.
 W. H. Powless. Report, '84, 2785.
 J. Burney. Reports, '80, 1338; '81, 1383; '82, 1507; '84, 2796.
 W. M. Rees. Reports, '81, 1391; '84, 2797; '85, 2775, 2957.
 F. S. Burrows. Reports, '82, 1522, '84, 2803.
 F. A. Fisher. Report, '84, 2807.
 R. Klemm. Report, '84, 2812.
 J. E. Turtle. Reports, '84, 2842; '85, 2794.
 H. D. Garden. Report, '84, 2856.
 G. M. Helm. Report, '84, 2858.
 W. G. Blunt. Report, '84, 2867.
 A. D. Wilson. Reports, '84, 2873; '85, 2833, 2982, 2985; '86, 2164.
 T. J. Dabney. Reports, '80, 1334; '81, 1385, 1386; '82, 1503.
 N. Stewart. Report, '85, 2593, 2609.
 O. W. Ferguson. Report, '85, 2652.
 E. H. Twining. Report, '85, 2691, 2719.
 W. A. Gould. Report, '85, 2755.
 W. L. Siddon. Report, '85, 2750.
 J. L. Riley. Report, '85, 2759.
 N. B. Craig. Report, '85, 2769.
 W. M. Childs. Report, '85, 2797.
 C. P. Rupple. Report, '85, 2800.
 E. C. Tollinger. Report, '85, 2802.
 E. D. Thompson. Report, '85, 2804.
 H. S. Douglass. Reports, '85, 2816, 2979; '87, 2906, 2910.
 H. B. Herr. Report, '82, 1499.

Legislation.

Recommended by the Commission, '82, 2764; '83, 2151; '84, 2428; '85, 2869.

Levees and Outlets.

General consideration of, '83, 2148; '84, 2422; '85, 2547, 2566, 2865, 2877.

Condition of levees, '84, 2862; '87, 2693.

Value of levees as aid to improving the river channel, '83, 2148, 2152; '84, 2425, 2431; '85, 2552, 2566, 2866, 2877.

Necessity for closing breaks in levees, '83, 2150; '84, 2422; '85, 2866.

Estimate for levees, '84, 2426.

Discharge from outlets, '85, 2582, 2588.

Rejection of the outlet system as an aid in the improvement of the river, '85, 2865.

Operations.

1879-'80. At Memphis, bank protection above Wolf River applied for a distance of 1,300 feet, '80, 1337, 1339. At Vicksburg, 1,700 feet of bank protection placed, '80, 1335. At mouth of Red River, 57,800 cubic yards dredged from bar, '80, 1282. At New Orleans Harbor, 16,628 square yards of shore protection placed, '80, 1146.

1880-'81. At Memphis, 1,150 feet of bank protection placed, '81, 1381, 1383. At Vicksburg, 1,000 feet of bank protection placed, '81, 1386. At Natchez and Vidalia, bank protection placed at Maringo Bend, '81, 1386, 1388. At mouth of Red River, 38,574 cubic yards dredged from inner bar, '81, 1389, 1390. At New Orleans, 12,060 square yards shore protection placed, '81, 1272.

1881-'82. At Memphis, 11,460 square yards of bank protection placed, '82, 1498, 1499. At Vicksburg, continuation of bank protection, '82, 1502, 1504. At Natchez and Vidalia, bank protection placed at Giles Bend, '82, 1507, 1510. At mouth of Red River, dredging continued, '82, 1511. At New Orleans, 44,456 square yards of shore protection placed in Carrollton Bend, '82, 187, 1355; suspension of operations under existing project ordered in September, 1881, '82, 1354, 1359. Works transferred to Mississippi River Commission, '82, 1512.

MISSISSIPPI RIVER—Continued.**Operations—Continued.**

1882. Bank protection and dike construction on Plum Point Reach, '83, 2121, 2279. Bank protection placed at Memphis Harbor, '83, 2122, 2282. Bank protection and dike construction on Lake Providence Reach, '83, 2123, 2285. Bank protection at Vicksburg Harbor, '83, 2124, 2290, 2294. Dredging at mouth of Red and Atchafalaya rivers, '83, 2125, 2297. Preparation for bank protection at New Orleans Harbor, '83, 2125, 2297. Repair of levees, '83, 2150, 2283, 2292, 2298, 2346.
1883. Bank protection and dike construction on Plum Point Reach, '84, 2413, 2757, 2764, 2768, 2772, 2776, 2779, 2780. Bank protection at Memphis Harbor and on Memphis Reach, '84, 2414, 2791, 2796, 2797, 2803, 2807. Bank protection and dike construction on Lake Providence Reach; bank protection and dredging at Vicksburg Harbor, '84, 2415, 2417, 2814, 2821, 2838, 2842, 2844. Dredging at mouth of Red and Atchafalaya rivers, '84, 2419, 2872. Bank protection at New Orleans Harbor, '84, 2421, 2879. Repair of levees, '84, 2422, 2792, 2812, 2824, 2827, 2856, 2858, 2868.
1884. Bank protection and dike construction on Plum Point Reach, '85, 2541, 2741, 2748, 2752, 2755, 2756, 2759, 2761, 2764, 2768; '86, 2144. Bank protection at Memphis Harbor, '85, 2543, 2772, 2775; '86, 2144. Bank protection on Memphis Reach, '85, 2542, 2772, 2775. Bank protection and dike construction on Lake Providence Reach, '85, 2544, 2784, 2789, 2794, 2797, 2800, 2802, 2812; '86, 2144. Bank protection at Vicksburg Harbor, '85, 2545, 2786, 2812; '86, 2144. Dredging operations at mouth of Red River, '85, 2546, 2833; '86, 2144. Bank protection and dike construction at New Orleans Harbor, '85, 2546, 2844; '86, 2144. Repair of levees, '85, 2547, 2787, 2815, 2816; '86, 2144, 2857.
1885. Bank protection and dike construction on the Plum Point Reach, '85, 2862, 2943, 2949; '86, 2158. Bank protection at Memphis Harbor, '85, 2862, 2955, 2957; '86, 2161. Repair and extension on dikes, Lake Providence Reach, '85, 2863, 2960, 2966; '86, 2162. Dike construction at mouth of Red River and dredging, '85, 2864, 2971, 2982; '86, 2164. Dike construction at New Orleans Harbor, '85, 2864, 2971, 2987; '86, 2164. Repairs to levees, '85, 2864, 2964, 2971, 2979.
- 1885-'86. Repairs to works on Plum Point Reach, '87, 2692, 2724. Repair of revetment at Hopefield Bend and ballasting part of revetment on Memphis City front, '87, 2692, 2731, 2750. Repair to Baleshed and Stack Island dikes, '87, 2693, 2736. Maintenance of channel at mouth of Red River by dredging and temporary wing-dams, '87, 2693, 2744, 2750. Repair of levees, '87, 2693.
- 1886-'87. Dike construction and repair on Plum Point Reach; construction of levee on upper side of Plum Point, '87, 2754, 2873. Extension of Memphis City front revetment, '87, 2755, 2878. Shore protection extended in Gouldsborough Bend; attempts to maintain channel at mouth of Red River, by dredging, and temporary wing-dam, '87, 2757, 2893, 2906.

Physical Characteristics.

- Relation between velocity and amount of sediment transported, '81, 2724.
- Sediment, amount of, '83, 2216, 2230; '85, 2880.
- Action of crevasses and side outlets, '81, 2725, 2728; '82, 2766; '83, 2300; '84, 2422.
- Loss of section at outlets, '84, 2422.
- Action of cut-offs, '81, 2725.
- Formation of cut-off at Vicksburg, '82, 2760.
- Relative volumes through the Passes, '81, 2727.
- Character of material forming bed of river, '81, 2734; '83, 2758; '84, 2885.
- Drainage basin of river above Saint Paul, '81, 2743.
- Slope of upper river, '81, 2744.
- Slope of lower river, '83, 2214; '85, 2551.
- Discharge of upper river, '81, 2744.
- Discharge of the lower river, '82, 2772; '83, 2214, 2220; '84, 2424, 2433, 2876; '87, 2707, 2815.
- Flood slopes, '81, 2772, 2778; '85, 2878, 2902, 2905.
- Flood records, '84, 2424, 2432; '85, 2596, 2621, 2636.
- Comparisons of river width at various times, '81, 2769; '84, 2687.
- Low-water slopes, '85, 2903.
- Mutual relations of sections under varying conditions of discharge and curvature, '82, 2759.
- Severe shore erosion at New Orleans, '82, 1361.
- Movement of sand waves, '83, 2195, 2216; '84, 2571.
- Bends and their relations to depth and section, '83, 2300.
- The blue clay formation, '83, 2315.

MISSISSIPPI RIVER—Continued.**Physical Characteristics—Continued.**

General physical characteristics, '83, 2339.

Range of high and low water, '85, 2550, 2905. (See also **MISSISSIPPI RIVER, WATER GAUGES ON.**)

Plans.

The levee system and its action, '81, 2731.

Total deflection of the Red into the Mississippi River, '82, 1514; '85, 2555, 2827.

Separation of the Red from the Mississippi River, '82, 1514; '85, 2559, 2827.

Rectification of Red River by preventing further enlargement and restricting its outlet capacity, '82, 1514; '85, 2560, 2567.

Private and Corporate Work.

Length of levees on lower river, '81, 2771, 2775.

Dimensions of levees, '81, 2778.

Faulty construction of New Orleans wharves, '82, 1364, 1367.

Projects.

At Memphis Harbor, Tenn., the project of 1877 proposed the protection against caving of the city water front along a distance of about 7,600 linear feet. Estimated cost, \$170,000, '77, 78, 492. Increased in 1882 to \$204,211. '82, 1498.

At Vicksburg Harbor, Miss., the project of 1877 proposed the protection of the city water front by shore protection at Delta Point, construction of a dike on the crest of the bar extending from De Sota Island, dredging in the inner harbor, and the diversion of Yazoo River. Estimated cost, \$2,084,100, '78, 633, 641; '82, 2761. The Mississippi River Commission in 1883 considered that further study should be given to the subject before final recommendation could be made, '84, 2419.

At Natchez and Vidalia the project of 1880 proposed the protection of the banks at Marengo and Giles bends so as to prevent the river from cutting through into Concordia Bend. Estimated cost, \$939,600, '80, 1333, 1353.

At the mouth of the Red River the Board of Engineers of 1880 recommended continuation of dredging as a means of temporary improvement, '80, 1238.

At New Orleans Harbor the project of 1878 proposed to protect the city front from caving by a shore protection of pile and brush revetment, aided by brush mats placed on the bottom and on shore slopes. Estimated cost, \$476,000, '78, 614, 616; '80, 1151; '82, 1362.

The Board of Engineers of 1881 recommended that the previously adopted plan of improvement be discontinued, '82, 1365. That at Carrollton Bend the necessity for bank protection is alone presented, and that the protection should consist of brush mattress of the greatest practical length and of the most substantial construction, '82, 1366-1368.

The project recommended by the Mississippi River Commission contemplated the improvement of the river below Cairo by the contraction of the water-way at all shoal points to a comparatively uniform width and the protection of banks from caving. It was considered that the necessary contraction of the water-way could be best accomplished by the use of permeable dikes, by which new shore-lines would be established, and the closing of chutes. By the use of mattress revetment the new shore-lines formed by the dikes were to be held, and wherever caving banks occurred they were to be protected against eroding by mattress revetment or some equivalent device, '81, 2733; '82, 2748, 2751; '83, 2120; '85, 2866. The Commission recommended that the initial work of improvement should be upon the 200 miles of river immediately below Cairo, '81, 2736; '82, 2754; '85, 2866.

In relation to levees it was considered by a majority of the Commission that while levees in themselves were not necessary as a means of securing ultimately navigable channels, nevertheless they believed that, besides giving protection to life and property against overflow, safety and ease to navigation, and facilities to commerce by establishing landing places above the reach of floods, the repair and maintenance of existing extensive lines of levees would hasten the work of channel improvement through the increased scour they would produce during high-river stages, '81, 2732; '83, 2353, 2373; '85, 2552, 2866.

At the junction of the Mississippi, Red, and Atchafalaya rivers the Commission considered works of protection and rectification necessary, '82, 1513, 2755, 2776; '85, 2554, 2869.

Surveys.

Between the Head of the Passes and the headwaters, '81, 2720, 2741; '82, 2745; '83, 2111; '84, 2408; '85, 2536, 2859.

Comparison of, '83, 2308.

MAPS.

From the Passes to Grand Prairie, '81, 2738.

MISSISSIPPI RIVER—Continued.**Surveys—Continued.****MAPS—Continued.**

List of maps and plates, '83, 2154; '84, 2440; '85, 2572.
 New Orleans Harbor, '85, 2987.
 Natchez Harbor, '82, 1510.
 From Saint Louis Bridge to Foster Island, '87, 1557.
 At Horsetail, '87, 1558.
 From Carroll's to Foster Island, '87, 1560.

MISSISSIPPI RIVER at its mouth.

(Continued from Vol. I, p. 330.)

Appropriations.

1837-'79	\$2,541,669.53	
1880. Survey, etc	20,000.00,	'80, 141.
1881. Survey, etc	10,000.00,	'81, 190.
1882. Survey, etc	10,000.00,	'82, 187.
1884. Survey, etc	6,000.00	'84, 207.
	10,000.00	
1886. Survey, etc	6,492.00	'86, 212.
	10,000.00	

Total

2,614,161.53

1888

10,000.00, act of August 11, 1888.

The amounts paid J. B. Fads for the improvement of South Pass under the acts of March 3, 1875, June 19, 1878, and March 3, 1879, are not stated in the reports of the Chief of Engineers.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 186; '83, 198; '84, 206; '85, 214; '86, 212; '87, 178.

ENGINEERS IN CHARGE.

Maj. W. H. Heuer, 1880-'84. Reports, '80, 1123; '81, 1245; '82, 1329; '83, 1031.

Capt. T. Turtle, 1884-'85. Report, '84, 1235.

Maj. W. H. Heuer, 1885— Reports, '85, 1377; '86, 1225; '87, 1345.

ASSISTANT.

C. Donovan. Reports, '80, 1123; '81, 1246; '82, 1331; '83, 1033; '84, 1237; '85, 1379; '87, 1347.

Operations.

1879-'80. At Head of Passes small additions were made to upper dam; on the east jetty the construction of cribs at the outer end and of a concrete and rubble masonry parapet on the jetty was in progress, '80, 1124. On the west jetty work was confined to placing spur-cribs and to repair of jetty, '80, 1134. Least depth through channel between jetties, 31 feet; least width of 30-foot channel, 40 feet; least width of 26-foot channel, 200 feet, '80, 1123, 1136.

1880-'81. In South Pass, after the failure of dredging to reduce shoal areas, spur-dikes were built from east shore, '81, 1247. On east jetty the placing of cribs at outer end and the construction of concrete and rubble masonry parapet was in progress, '80, 1248. Localities of dredging operations, '80, 1257. Least depth of through channel between jetties, 30 feet; least width of 30-foot channel, 20 feet; least width of 26-foot channel, 230 feet, '81, 1245, 1262, 1268.

1881-'82. In South Pass, the old dam near head of Bayou Grande was rebuilt for a length of 95 feet; new dam built across Picayune Bayou; at mouth of South Pass, small additions made to masonry work and temporary works built to improve channel; on the east jetty 16 spur-cribs were placed and additions made to the masonry parapet; 1,813 linear feet of levee built along sea side of east jetty and 2,125 linear feet built along the west jetty; 19 lattice wing-dams built; dredging in operation during 87 days; '82, 1329, 1332, 1335, 1336, 1340. Least depth through channel between the jetties, 30½ feet; least width of 30-foot channel, 60 feet; least width of 26-foot channel, 210 feet, '82, 1329, 1344, 1350.

1882-'83. In South Pass, 11 wing-dams built; 6,810 linear feet of auxiliary jetty built within and nearly parallel to line of east jetty; dredging in operation during 17 days, '83, 1032, 1034, 1036. Least depth through channel between jetties, 31 feet; least width of 30-foot channel, 90 feet; least width of 26-foot channel, 240 feet, '83, 1031, 1040, 1044.

MISSISSIPPI RIVER—Continued.**Operations—Continued.**

- 1883-'84. In South Pass, 2 wing-dams built; repairs to Picayune Bayou Dam; inner east jetty extended 1,630 feet; wing-dam built at head of east jetty; no dredging done since February, 1883, '84, 1236, 1238, 1239. Least width through channel between jetties, 34 feet; least width of 30-foot channel, 150 feet; least width of 26-foot channel, 270 feet, '84, 1236, 1242, 1246.
- 1884-'85. Extension of the inner east jetty 605 feet; repair of wing-dam, outer end of east jetty; no dredging done since February, 1883, '85, 1377, 1380. Least depth through channel between the jetties, $31\frac{1}{2}$ feet; least width of 30-foot channel, 130 feet; least width of 26-foot channel, 270 feet, '85, 1377, 1385.
- 1885-'86. Construction commenced on the inner west jetty; repairs to inner east jetty; construction and repair of west jetty wing-dams, '86, 1226. Least depth through channel between the jetties, $33\frac{1}{2}$ feet; least width of 30-foot channel, 170 feet; least width of 26-foot channel, 240 feet, '86, 1231.
- 1886-'87. Extension and repair to wing-dams in South Pass; repairs to inner east jetty; extension of inner west jetty; construction and repair to west jetty wing-dams; injury to masonry superstructure by gale of October, 1886, '87, 1348, 1349. Least depth through channel between the jetties, $32\frac{1}{2}$ feet; least width of 30-foot channel, 130 feet; least width of 26-foot channel, 250 feet; improvement of channel at outer ends of jetties, '87, 1345, 1354.

Physical Characteristics.

- Extent of deposits over area outside of jetty ends, '80, 1123, 1132; '81, 1246, 1263; '82, 1330, 1347, 1348; '83, 1042; '84, 1236, 1244; '85, 1377, 1387; '86, 1234; '87, 1345, 1351, 1355.
- Deepening of Pass à l'Outre since 1875, '82, 1330.
- Force of waves at outer end of jetties, '83, 1032; '87, 1349.
- Movement of sand waves, '87, 1351.

Projects.

The projects for the improvement of the mouths of the Mississippi from 1837 to 1878, inclusive, proposed the formation and maintenance of a channel 18 feet deep, through either Southwest Pass or Pass à l'Outre, by stirring the bottom and by dredging. This method of improvement was discontinued in 1878, when the improvement of South Pass by jetties had attained a depth of 18 feet. Inclusive of surveys, there was appropriated under these projects from 1829 to 1879, inclusive, \$2,541,669.53.

The act of March 3, 1875, authorized James B. Eads to build jetties and other works in South Pass, for the purpose of ultimately obtaining and maintaining a channel 300 feet wide and 30 feet deep over the bar at the mouth of the Pass through the Pass into the river above.

The acts of June 19, 1878, and March 3, 1879, amended the original act so that James B. Eads was only required to obtain a channel 26 feet deep, 200 feet wide at bottom, and having through it a central depth of 30 feet without regard to width, these channels to be maintained for twenty years from July 8, 1879. For this James B. Eads was to ultimately receive \$5,252,000, and in addition \$100,000 per annum for maintaining this channel.

Surveys.**MAPS.**

Channel between jetties, '80, 1144; '81, 1270; '82, 1352; '83, 1046; '84, 1242, 1248; '85, 1390; '86, 1238. Depths over area seaward from the end of the jetties, '80, 1144; '81, 1270; '82, 1352; '83, 1042, 1046; '84, 1243, 1248; '85, 1390; '86, 1238.

List of charts accompanying reports, '81, 1246; '82, 1331; '83, 1033; '84, 1237, '85, 1379; '86, 1225. South Pass, '86, 1236; '87, 1256.

MISSISSIPPI RIVER—WATER-GAUGES ON.

(Continued from Vol. I, p. 327.)

Appropriations.

1876-'79	\$15,000
1880	5,000, '80, 1342.
1881	5,000, '81, 1437.
1882	5,000, '82, 1562.
1884	{ 2,100, '84, 1341.
	{ 5,000, '84, 1341.
1886	5,000, '86, 1369.

Total..... 42,100
 1888 9,600, act of August 11, 1888.

MISSISSIPPI RIVER—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 212; '82, 210; '83, 218; '84, 226; '85, 243; '86, 237; '87, 202.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaund, 1874-'82. Reports, '80, 1342; '81, 1436; '82, 1561.

Maj. A. M. Millor, 1882-'84. Reports, '83, 1162; '84, 1341.

Capt. E. Bergland, 1884-'86. Reports, '85, 1532; '86, 1368.

Capt. J. H. Willard, 1886-'— Report, '87, 1485.

ASSISTANT.

H. B. Herr. Report, '81, 1437.

Physical Characteristics.

List of water-gauges, '81, 1438; '85, 1533; '87, 1485.

Water-gauge records, '80, 1342; '81, 1439; '82, 1562; '83, 1163; '84, 1341; '85, 1532; '86, 1369; '87, 1485.

High and low water records, '81, 1439, 1448.

Height of freshets, '81, 1448; '82, 1562; '83, 1163; '84, 1341; '85, 1534; '86, 1369.

Effect of tributaries on high water in Mississippi River, '81, 1450.

Rate of progress of high-water wave, '81, 1451.

MISSOURI RIVER—SURVEY OF, FROM MOUTH TO FORT BENTON, INCLUDING SURVEY FROM MOUTH TO SIOUX CITY.

(Continued from Vol. I, p. 339.)

Appropriations.

1878..... \$50,000, '78, 658.

1879..... 30,000, '79, 1083.

1880..... 30,000, '80, 1461.

1881..... 30,000, '81, 1659.

1882..... 40,000, '82, 1725.

Total..... 180,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 167; '81, 229; '82, 226; '83, 233; '84, 237; '85, 258; '86, 248; '87, 241.

ENGINEER IN CHARGE.

Maj. C. R. Suter, 1878-'84. Reports, '80, 1460; '81, 1659; '82, 1724; '83, 1332; '84, 1538; '85, 1654. Transferred October 21, 1884, to Missouri River. Commission Reports, '85, 1654, 2994, 2996, 3001; '86, 2167; '87, 2913, 3031.

ASSISTANTS.

D. W. Wellman. Reports, '82, 1725; '83, 1332; '84, 1538; '87, 2946, 3063.

O. B. Wheeler. Report, '87, 2929, 2931, 2934, 2950, 2955, 2958, 2963, 2966, 2983, 3074, 3079, 3124.

J. A. Seddon. Report, '87, 2971, 3079.

A. H. Blaisdell. Report, '87, 2974.

A. Warren. Report, '87, 2948.

Operations.

1879-'83. Survey between mouth and Sioux City in progress, '80, 1460; '81, 1659; '82, 1725; '83, 1332.

1883-'84. Survey completed and maps published for the river from mouth to Fort Pierre, a distance of 1,174 miles. Further operations transferred to Missouri River Commission, '84, 1538.

1884-'85. Secondary triangulation in progress below Glasgow, '85, 2996, 3001. Survey in progress between Fort Benton and Sioux City, '85, 3006.

1885-'86. Survey in progress on Upper Missouri, '86, 2167.

1886-'87. Survey in progress, '87, 2913, 2922, 2927, 2942, 2946, 2950, 2961, 3031, 3032, 3043, 3079.

Physical Characteristics.

Low-water slope, '82, 1729; '83, 1337.

Table of distances, '82, 1729; '83, 1337; '84, 1540.

Discharge observations, '87, 3081.

Sediment observations, '87, 3090, 3121.

Surveys.**MAPS.**

Showing extent of secondary triangulation, '87, 2934, 3053.

MISSOURI RIVER, FROM MOUTH TO SIOUX CITY—IMPROVEMENT OF.

(Continued from Vol. I, p. 339.)

Including improvement at Atchison, Kans., Brownville, Nebr., Cedar City, Mo., Council Bluffs, Iowa, and Omaha, Nebr., Eastport, Iowa, and Nebraska City, Nebr., Fort Leavenworth, Kans., Glasgow, Mo., Kansas City, Mo., Lexington, Mo., Plattsmouth, Nebr., Saint Charles, Mo., Saint Joseph, Mo., Sioux City, Iowa; also surveys at Arrow Rock, Booneville, Brunswick, and Tuque Creek, Mo.

Appropriations.

1876-79.....	\$406,500
1880 {	At Atchison..... 20,000, '80, 1418.
	At Brownville..... 10,000, '80, 1423.
	At Cedar City..... 15,000, '80, 1405.
	At Council Bluffs and Omaha.. 20,000, '80, 1437.
	At Eastport and Nebraska City 14,000, '80, 1426.
	At Fort Leavenworth..... 8,000, '80, 1414.
1881 {	At Glasgow..... 20,000, '80, 1406.
	At Kansas City..... 25,000, '80, 1410.
	At Lexington..... 15,000, '80, 1410.
	At Plattsmouth..... 10,000, '80, 1436.
	At Saint Charles..... 25,000, '80, 1405.
	At Saint Joseph..... 20,000, '80, 1421.
	At Sioux City..... 8,000, '80, 1453.
	At Atchison..... 20,000, '81, 1620.
	At Brownville..... 10,000, '81, 1626.
	At Cedar City..... 15,000, '81, 1607.
	At Council Bluffs and Omaha.. 30,000, '81, 1637.
	At Eastport and Nebraska City 20,000, '81, 1630.
	At Fort Leavenworth..... 8,000, '81, 1617.
1882 {	At Glasgow..... 20,000, '81, 1610.
	At Kansas City..... 20,000, '81, 1615.
	At Lexington..... 10,000, '81, 1613.
	At Plattsmouth..... 10,000, '81, 1634.
	At Saint Charles..... 15,000, '81, 1604.
	At Saint Joseph..... 20,000, '81, 1623.
	At Sioux City..... 7,000, '81, 1642.
1882.	From mouth to Sioux City..... 850,000, '82, 1733.
1884.	From mouth to Sioux City..... 500,000, '85, 2990.
1886.	From mouth to Sioux City.. .. 375,000, '86, 458.

Total..... 2,546,500

[\$1,000,000 appropriated for Missouri River from mouth to Fort Benton by act of August 11, 1888.]

Commerce.

Justification of improvement, '81, 1650; '85, 2992; '87, 2988, 2994, 3010, 3012, 3041.

Bridge requirements, '87, 3060.

Engineers.

CHIEF OF ENGINEERS.

Atchison. Reports, '80, 164; '81, 266; '82, 223; '83, 232; '84, 237.
Brownville. Reports, '80, 165; '81, 227; '82, 224; '83, 232.
Cedar City. Reports, '80, 163; '81, 224; '82, 222; '83, 231.
Council Bluffs and Omaha. Reports, '80, 166; '81, 228; '82, 224; '83, 233.
Eastport and Nebraska City. Reports, '80, 165; '81, 227; '82, 224; '83, 232.
Fort Leavenworth. Reports, '80, 161; '81, 226; '82, 223; '83, 232.
Glasgow. Reports, '80, 163; '81, 225; '82, 222; '83, 231.
Kansas City. Reports, '80, 163; '81, 225; '82, 223; '83, 231.
Lexington. Reports, '80, 163; '81, 225; '82, 223; '83, 231.
Plattsmouth. Reports, '80, 165; '81, 227; '82, 224; '83, 232.
Saint Charles. Reports, '80, 162; '81, 224; '82, 222; '83, 231.
Saint Joseph. Reports, '80, 164; '81, 226; '82, 224; '83, 232.
Sioux City. Reports, '80, 166; '81, 224; '82, 225; '83, 233.
From mouth to Sioux City. Reports, '81, 229; '82, 226; '84, 237; '85, 258; '86, 248; '87, 341.

ENGINEERS IN CHARGE.

Maj. C. R. Suter, 1875-'84:

Atchison. Reports, '80, 1417; '81, 1617; '82, 1694; '83, 1305, 1330; '84, 1536.
Brownville. Reports, '80, 1423; '81, 1625; '82, 1701; '83, 1303.

MISSOURI RIVER—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE—Continued.**

Maj. C. R. Suter, 1875-'84—Continued.

Cedar City. Reports, '80, 1405; '81, 1606; '82, 1680; '83, 1328.

Council Bluffs and Omaha. Reports, '80, 1436; '81, 1636; '82, 1712; '83, 1303, 1331.

Eastport and Nebraska City. Reports, '80, 1425; '81, 1629; '82, 1702; '83, 1303, 1330.

Fort Leavenworth. Reports, '80, 1413; '81, 1617; '82, 1691; '83, 1323.

Glasgow. Reports, '80, 1406; '81, 1609; '82, 1682; '83, 1303, 1328.

Kansas City. Reports, '80, 1410; '81, 1614; '82, 1689; '83, 1305, 1329.

Lexington. Reports, '80, 1409; '81, 1613; '82, 1687; '83, 1329.

Plattsmouth. Reports, '80, 1435; '81, 1634; '82, 1709; '83, 1330.

Saint Charles. Reports, '80, 1404; '81, 1604; '82, 1676; '83, 1302, 1328.

Saint Joseph. Reports, '80, 1421; '81, 1622; '82, 1693; '83, 1305, 1330.

Sioux City. Reports, '80, 1453; '81, 1642; '82, 1718; '83, 1303, 1331.

From mouth to Sioux City. Reports, '81, 1647, 1649; '82, 1731; '83, 1301; '84, 1533; '85, 1654, 3017.

Transferred to Missouri River Commission. Reports, '84, 237; '85, 2989, 2999; '86, 2167; '87, 2419, 3026, 3097.

Surveys, Arrow Rock, Mo., '82, 1733. Boonville, Mo., '81, 1661. Brunswick, Mo., '81, 1668. Tuque Creek, Mo., '81, 1667; '87, 2914, 3026, 3097.

ASSISTANTS.**Arrow Rock:**

S. W. Fox. Report, '82, 1734.

Atchison:

D. W. Church. Reports, '80, 1418; '83, 1325.

Brownville:

Capt. T. H. Handbury. Report, '80, 1425.

W. H. Hammond. Report, '81, 1626.

I. W. Pearl. Report, '82, 1702.

Cedar City:

S. W. Fox. Report, '80, 1405.

T. C. Bradley. Report, '81, —

Omaha:

C. B. Davis. Report, '80, 1437.

C. S. Pease. Reports, '80, 3637; '82, 1712; '83, 1303; '84, 1536

Eastport:

L. E. Cooley. Report, '80, 1426.

A. S. Potter. Reports, '81, 1630; '82, 1706; '83, 1311.

Fort Leavenworth:

D. W. Church. Report, '80, 1414.

G. T. Nelles. Reports, '81, 1617; '82, 1692.

Glasgow:

S. W. Fox. Reports, '80, 1407; '81, 1610; '82, 1683.

Kansas City:

J. W. Nicr. Reports, '80, 1410; '81, 1615; '82, 1690; '83, 1315.

S. H. Yonge. Reports, '83, 1316; '84, 1537; '85, 3023; '87, 3098.

Lexington:

E. C. Shankland. Reports, '81, 1634; '82, 1688.

Plattsmouth:

W. H. McKnew. Reports, '81, 1634; '82, 1709.

Capt. T. H. Handbury. Report, '80, 1450.

Saint Charles:

L. E. Cooley. Report, '81, 1604.

T. M. Harris. Reports, '82, 1676; '83, 1306.

S. W. Fox. Reports, '83, 1309; '85, 3027.

Saint Joseph:

D. W. Church. Reports, '80, 1421; '81, 1623; '82, 1699; '83, 1324.

S. W. Fox. Report, '87, 3107.

Sioux City:

S. H. Yonge. Reports, '80, 1454; '81, 1242; '82, 1719.

Operations.

All operations by hired labor.

1879-'80. At Atchison, 2,572 feet of bank at McQueen's Bend revetted, '80, 1417.

At Cedar City, 1,100 feet of shore revetment placed along city front and 1,900 feet of weed dike placed near Cedar City Bend, '80, 1405, '82, 1680. At Council Bluffs, 800 feet of floating weed dike placed and 5,550 feet of bank revet-

MISSOURI RIVER—Continued.**Operations—Continued.**

- ment constructed; 800 feet of experimental wire curtain placed in bend below Florence, '80, 1436-1449. At Eastport, repairs to work of previous season, 1,200 feet of sand fence, 3,000 feet of willow curtain dike, and 1,000 feet of wire screen dike placed, '80, 1425-1435. At Fort Leavenworth, 1,570 feet shore revetment placed at mouth of Bee Creek, 300 feet of brush dike placed below bridge, '80, 1414. At Glasgow, 2,385 feet weed dike and 1,900 feet of shore protection placed, '80, 1406. At Kansas City, repairs to previous work and 5,042 feet of shore protection placed, '80, 1410. At Saint Joseph, 2,000 feet of shore revetted in front of city, '80, 1421. At Sioux City, repairs to dike of previous season, 300 feet floating brush dike, and 2,000 feet of shore protection placed, '80, 1453.
- 1880-'81. At Brownville, closure of Sonora Chute with weed dike; preparation for construction of wire net dike, '81, 1626, 1628; '82, 1702. At Cedar City, wire screen dike placed at Cedar City Bend to replace the failing weed dike, '81, 1606, 1608; '82, 1680. At Council Bluffs, operations confined to repairs of former work, '81, 1636. At Eastport, previous season's work swept away; 1,800 feet brush fence placed on bar opposite Neligh's; 2,250 feet brush dike placed near Copeland's Bend, '81, 1629, 1632; '82, 1708. At Fort Leavenworth, operations confined to repairs of old work, '81, 1617. At Glasgow, 5,630 feet of bank revetted in bend above city, '81, 1609. At Lexington, 5,000 feet of shore revetment placed above city, '81, 1613. At Saint Charles, closure of chute behind island, construction of dike at head of island and at Downing's Point, '81, 1604. At Saint Joseph, repair of old work, '81, 1622. Surveys made at Boonville, '81, 1661; at Brunswick, '81, 1668, and at Tuque Creek, '81, 1667.
- 1881-'82. At Atchison, construction of permeable dikes continued, '82, 1694. Methods of construction, '82, 1696. At Brownville, completion of wire screen dike closing Sonora Chute; ultimate destruction of the wire, '82, 1701, 1703. At Cedar City, completion of wire screen dike at Cedar City Bend, '82, 1680. At Council Bluffs, repairs to Omaha revetment; dike and training-wall construction near Florence, '82, 1712, 1714. At Eastport, buoy and pile-dike built above Copeland's Bend, '82, 1705, 1708. At Fort Leavenworth, repair of work of previous year; destruction of works, '82, 1694. At Glasgow, shore revetment placed at Cambridge and Middle bends, '82, 1682. At Kansas City, revetment of bank below Quindaro, '82, 1698. At Lexington, 3,160 feet of stone protection placed opposite city, '82, 1688. At Plattsmouth, construction of training dike at mouth of river, '82, 1709, 1710. At Saint Charles, continuation of dike construction at Downing's Point and Saint Charles Island, '82, 1676, 1678. At Saint Joseph, shore protection and dike work at Bon Ton Bend, and revetment at Ellwood Point, '82, 1699. At Sioux City, construction of wire screen dike from right bank 12 miles below city, '82, 1718. Survey of Arrow Rock, Mo., '82, 1733.
- 1882-'83. At Atchison, permeable training dikes were constructed from the left bank above the bridge for the rectification of the channel approaching the bridge, '83, 1305, 1325. At Council Bluffs, operations were confined to repairs of the Omaha revetment and discharge observations at Florence, '83, 1303. At Eastport, 5,160 feet of revetment placed in the bend above Eastport, '83, 1303, 1311. At Kansas City, 8,750 feet of revetment placed in Kaw Bend, '83, 1305, 1316. At Lexington, 4,200 feet of revetment placed on left bank, opposite city, '83, 1305, 1315. At Saint Charles, 2,250 feet of shore revetment placed at Saint Charles Bend, '83, 1302, 1309. At Saint Joseph, the Ellwood revetment was repaired and extended, '83, 1305, 1324. At Sioux City, extension of training dike commenced in 1879-'80 destroyed during winter, '83, 1303, 1314.
- 1883-'84. Completion of Saint Charles Bend revetment; Omaha revetment extended 1,270 feet and 2,500 feet of old work repaired; construction and repair of plant, '84, 1534.
- 1884-'85. Operations continued under direction of Missouri River Commission; revetment placed at Parkville and Quindaro and Kaw bends, '85, 3002, 3016, 3021, 3024.
- 1885-'86. Bank revetment placed in vicinity of Saint Joseph and Kansas City, '86, 2167.
- 1886-'87. Progress on Ellwood revetment at Saint Joseph and on protection of banks at Kaw and Quindaro bends, '87, 2914. Bank revetment at Bon Ton Bend; pile-dike construction and shore revetment near Kansas City, '87, 3031, 3097, 3098, 3107.
- Physical Characteristics.**
 General description of river, '81, 1650.
 Cross-sections before and after improvement at Atchison, '83, 1328.

MISSOURI RIVER—Continued.**Physical Characteristics—Continued.**

- Changes in 1880 in vicinity of Brownville, '81, 1627.
 Changes in 1880 in vicinity of Omaha, '81, 1637.
 Formation of cut-off near Omaha, '82, 1712.
 Ice observations at Nebraska City, '81, 1630.
 Floods in 1881, '81, 1643; '83, 2757.
 River sections, slope, and discharge, '81, 1644, 1650, 1651.
 Drift deposits, '81, 1651.
 Sediment, '81, 1651; '87, 3090, 3121.
 Depth of bed rock, '81, 1651.
 Discharge observations, '87, 3081.

Plans.

- By Maj. Suter for the improvement of the river at Arrow Rock, Boonville, Brunswick, and Tuque Creek, Mo., by the construction of permeable dikes and shore protection, '81, 1661, 1667, 1668; '82, 1733.

Projects.

- By Maj. Suter for the improvement of the Missouri River by the arrest of deposits at portions of the river that it is designed to abandon, thereby causing the river to build up new banks and excavate new channels at portions requiring improvement, the holding of such new lines and the protection of banks against erosion by light mattress protection. Estimated cost, \$10,000 per mile, '81, 1658; '82, 226, 1732. Approved by Missouri River Commission, '85, 2991, 2999, 3003.

Surveys.

- At Arrow Rock, Mo., ordered by act of March 3, 1881. Made under direction of Maj. Suter, 1881, '82, 1773.
 At Boonville, Brunswick, and Tuque Creek, Mo., ordered by act of June 14, 1880. Made under direction of Maj. Suter, 1880, '81, 1661, 1667, 1668.

MAPS.

- Vicinity of Atchison, Kans., '82, 1696; '83, 1328; '87, 3118.
 Vicinity of Brownville, Nebr., '87, 3118.
 Vicinity of Boonville, Mo., '81, 1662.
 Vicinity of Arrow Rock, '87, 3118.
 Vicinity of Brownsville, Mo., '82, 1702.
 Vicinity of Camden, Mo., '87, 3119.
 Vicinity of Brunswick, Mo., '81, 1668.
 Vicinity of Cedar City, Mo., '82, 1680.
 Vicinity of Council Bluffs, Iowa, '82, 1716; '87, 3118.
 Vicinity of Fort Leavenworth, Kans., '82, 1692; '84, 1538; '87, 3118.
 Vicinity of Glasgow, Mo., '80, 1406; '82, 1682.
 Vicinity of Kansas City, Mo., '82, 1690; '83, 1316; '84, 1538; '87, 3098, 3118.
 Vicinity of Lexington, Mo., '82, 1688; '83, 1328; '84, 1538.
 Vicinity of Nebraska City, Nebr., '80, 1434; '82, 1708; '83, 1330; '87, 3118.
 Vicinity of Plattsmouth, Nebr., '82, 1710; '87, 3118.
 Vicinity of Saint Charles, Mo., '82, 1678; '83, 1328.
 Vicinity of Saint Joseph, Mo., '82, 1700; '83, 1326; '87, 3110, 3118.
 Vicinity of Sioux City, Iowa, '82, 1718.
 Vicinity of Tuque Creek, Mo., '81, 1668.
 Leavenworth to Saint Louis, '87, 3052.

MISSOURI RIVER, between Sioux City, Iowa, and Fort Benton, Mont. (INCLUDING MISSOURI RIVER ABOVE THE MOUTH OF THE YELLOWSTONE RIVER, AND MISSOURI RIVER AT NIOBEARA, NEBR., VERMILLION, DAK., AND YANKTON, DAK.).

(Continued from Vol. I, p. 339.)

Appropriations.

1876-79	\$100,000
1880 { Above mouth of Yellowstone.....	25,000, '80, 1474.
{ At Vermillion, Dak.....	10,000, '80, 1457.
1881 { Above mouth of Yellowstone.....	40,000, '81, 1674.
{ At Vermillion, Dak.....	15,000, '81, 1646.
1882. From Sioux City to Fort Benton..	100,000, '83, 1371.

MISSOURI RIVER—Continued.**Appropriations**—Continued.

1884	{ From Sioux City to Fort Benton..	125,000, '85, 3004.
	{ Survey above Fort Benton.....	15,000, '85, 3004.
1886.	From Sioux City to Fort Benton..	60,000, '86, 248.

Total 490,000

[\$1,000,000 appropriated for Missouri River from mouth to Fort Benton by act of August 11, 1868.]

Total appropriations previous to July 5, 1884, \$290,000, '85, 2993.

Commerce.

Justification of improvement, '81, 1674; '83, 1361; '85, 3032; '87, 1601, 2988, 3010, 3012, 3021.

Early commerce of the river, '83, 1342.

List of boats navigating upper river, '83, 1344; '87, 2994, 3025.

Engineers.**CHIEF OF ENGINEERS.**

Above the mouth of the Yellowstone. Reports, '80, 169; '81, 230; '82, 227.

At Niobrara, Nebr. Reports, '80, 169; '81, 230.

At Vermillion, Dak. Reports, '80, 167; '81, 228; '82, 225; '83, 233.

At Yankton, Dak. Reports, '80, 169; '81, 230.

Between Sioux City and Fort Benton. Reports, '83, 234; '84, 237; '85, 258; '86, 248; '87, 215, 341.

ENGINEERS IN CHARGE.

Maj. C. R. Suter, 1875-'82:

At Niobrara, Nebr. Report, '81, 1665.

At Vermillion, Dak. Reports, '80, 1456, 1458; '81, 1645; '82, 1722; '83, 1331.

At Yankton, Dak. Report, '81, 1663.

Transferred to Capt. E. Maguire October, 1882. Report, '83, 1331.

Capt. E. Maguire, 1877-'83:

Above mouth of Yellowstone. Reports, '80, 1471; '81, 1671; '82, 1741.

Between Sioux City and Fort Benton. Report, '83, 1339.

Capt. J. B. Quinn, 1883-'86. Reports, '83, 1367; '84, 1541; '85, 3029.

Missouri River Commission, 1884, '85, 258, 2989. Reports, '85, 2989; '86, 2167; '87, 2914, 3026.

Capt. C. B. Sears. Report, '87, 1597.

ASSISTANTS.

T. T. Johnston. Report, '81, 1663, 1666.

W. H. Wood. Report, '83, 1371.

Operations.

History of operations previous to 1883, '83, 1355.

1879-'80. Repair of dam at Dauphin's Rapids; removal of 1,064 cubic yards of rock from eleven localities and the construction of 3,700 feet of stone and brush dams; survey of river from Dauphin's to Bird's Rapids and above Great Falls, '80, 1472, 1473.

1880-'81. 1,165 cubic yards rock removed from channels; 5,481 cubic yards stone placed in dams; survey from Dauphin's to Gallatin Rapids and at Snake Point, '81, 230, 1673. Survey at Niobrara, Nebr., '81, 1665. At Yankton, Dak., '81, 1663.

1881-'82. Removal of rock from rapids and construction of dams below Fort Benton, '82, 227, 1742. Below Vermillion, Dak., 8,000 feet of wire screen dike built, '82, 1722.

1882-'83. Removal of rock from rapids and construction of dams between Fort Benton and Bismarck, '83, 234, 1371. Statement of work already accomplished, '83, 1356.

1883-'84. Removal of rock from channels and construction of dams between Fort Benton and Bismarck, '84, 238, 1547. Work transferred to Missouri River Commission.

1884. Preparations for work of coming season, '85, 3002, 3030.

1885-'86. Removal of rock and construction of dams above Carroll, '86, 2167. Dam construction at Grand Island, Hammond Island, and Dauphin's Rapids, '87, 3022.

1886-'87. Repair of plant and care of property, '87, 1598, 2914.

Physical Characteristics.

Formation of cut-off at Vermillion, Dak., in 1881, '81, 1645.

Description of upper river, '83, 1339, 1345; '85, 2993.

Slope and discharge of upper river, '80, 1474; '83, 1340, 1351.

Rainfall, '83, 1346.

Dates of river opening and closing, '83, 1348.

MISSOURI RIVER—Continued.**Projects.**

Operations, except at Vermillion, Dak., have been confined to that part of the river lying between the mouth of the Yellowstone and Fort Benton, and have consisted in the improvement of the channel at rapids and shoals, by the removal of rock and the construction of dams, '78, 695-700; '79, 1096; '83, 1355; '84, 1542.

At and below Vermillion, Dak., the projects have been directed to the rectification of the river by shore protection and permeable dikes '79, 1079; '82, 1722.

In 1885 the Missouri River Commission recommended that for the present work be mainly confined to the construction of dams and dredging of shoals on "the rocky river" above Carroll; below that point the snag-boat should be kept at work and certain experimental dams constructed near Bismarck, '85, 3003.

Surveys.

Of river at Yankton, Dak., and Niobrara, Nebr., ordered by act of June 14, 1880, '80, 169. Made under direction of Maj. Suter, 1880, '81, 1663, 1665.

MAPS.

Vicinity of Yankton, Dak., '81, 1664. Vermillion, Dak., '82, 1722. Dauphin's Rapids, Con Island, and Grand Island, '82, 1742. Of parts of river improved between 1877 and 1883, '84, 1542.

MISSOURI RIVER—REMOVING SNAGS BETWEEN KANSAS CITY AND THE MOUTH.

(See Vol. I, p. 576.)

Appropriations.

1880. For removing snags, wrecks, and other obstructions in the Mississippi, Missouri, and Arkansas rivers	\$300,000, '80, 276.
1881	{ 35,000, '81, 1647.
1882	{ 80,000, '81, 1601.
1884	65,000, '82, 1675.
1886	50,000, '84, 1533.
1886	22,500, '86, 1395.

Total..... 452,500

Contracts.

1885. J. Rees, for hull of a steel and iron snag-boat, \$51,500. '85, 1635.

1886. J. D. Lavoisin, for upper works of new snag-boat, \$13,000, '86, 1395.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 162; '81, 223, 229; '82, 222, 225; '83, 229, 230; '84, 236; '85, 252; '86, 244; '87, 211.

ENGINEERS IN CHARGE.

Maj. C. R. Suter, 1873-'84. Reports, '80, 1402; '81, 1599, 1647; '82, 1675, 1724; '83, 1297; '84, 1531; '85, 1653.

Maj. A. M. Miller, 1884-'—. Reports, '85, 1634; '86, 1394; '87, 1515.

Operations.

1879-'80. 1,522 snags and 19 drift piles removed, '80, 1402.

1880-'81. 1,022 snags and 25 drift piles removed, '81, 1601.

1881-'82. 1,716 snags and 12 drift piles removed, '82, 1724.

1882-'83. 1,262 snags and 11 drift piles removed, '83, 1299, 1301.

1883-'84. 901 snags and 17 drift piles removed, '84, 1532.

1884-'85. 1,041 snags and 11 drift piles removed; hull of new snag-boat in process of construction, '85 1635, 1653.

1885-'86. 546 snags removed, new snag-boat in process of construction, '86, 1394.

1886-'87. New snag-boat completed, description of; 624 snags removed, '87, 1555.

MOBILE HARBOR, ALA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 342.)

Appropriations.

1826-'79	\$739,830.68 .
1880	125,000.00, '80, 1051.
1881	100,000.00, '81, 1172.

MOBILE HARBOR, ALA.—Continued.**Appropriations—Continued.**

1882.....	\$125,000.00, '82, 1251.
1884.....	200,000.00, '84, 1158.
1886.....	90,000.00, '86, 1189.

Total 1,379,830.68

1888..... 250,000.00, act of August 11, 1888.

List of appropriations, '83, 958; '87, 1294.

Commerce.

Commerce of port of Mobile, '80, 1056.

Amount of, dependent upon improvement, '80, 1057.

Benefits resulting from improvement, '86, 1189.

Contracts.

1880. G. C. Fobes & Co., for dredging, at 12.3 cents per cubic yard, '80, 1170.

1881. G. L. Long, for dredging, at 11 cents per cubic yard, '82, 1247.

1882. R. Moore, for dredging, at 12½ cents per cubic yard, '83, 960.

1884. T. Burke, for dredging, at 9 cents per cubic yard, '85, 1337.

1886. R. Moore, for dredging, at 9½ cents per cubic yard, '87, 1297.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 133, 1059; '81, 180; '82, 176; '83, 186; '84, 194; '85, 207, 214; '86, 205; '87, 171.

BOARD OF ENGINEERS.

Convened at New York, February 28, 1880, to report upon plans and estimates by Capt. Damrell for 17 and 22 foot channel from the fleet anchorage through the bay, into Mobile River. Report, '80, 1060. (Cols. Tower and Newton and Maj. Abbot.)

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1873-'—. Reports, '80, 1049; '81, 1169; '82, 1245; '83, 957; '84, 1152; '85, 1336, 1374, 1375; '86, 1183; '87, 1293.

Operations.

History of operations from 1827 to 1882, '82, 1245.

1880-'81. 143,149 cubic yards material dredged, '81, 1170.

1881-'82. 1,315,604 cubic yards material dredged, '82, 1247, 1248.

1882-'83. 1,138,447 cubic yards material dredged, '83, 961.

1883-'84. 888,093 cubic yards material dredged, '84, 1153.

1884-'85. 1,296,841 cubic yards material dredged, '85, 1337.

1885-'86. 623,597 cubic yards material dredged, '86, 1185.

1886-'87. 829,854 cubic yards material dredged, '87, 1295. Statement of total dredging done from 1879 to 1886, '87, 1295.

Physical Characteristics.

Of Mobile Bay, '80, 1060.

Plans.

By Maj. Damrell, 1879, for channels 17 and 22 feet deep, '79, 800; '80, 1059.

Consideration of, by Board of Engineers of 1880, '80, 1060, 1066.

Projects.

The earliest appropriation was made in 1826, and they were continued at irregular intervals to 1852, at which time there had been appropriated \$228,830.68.

This resulted in the formation of a dredged channel 200 feet wide and 10 feet deep through the Pass and Dog River Bar, '82, 1246.

No appropriations were made between 1852 and 1870.

The projects of 1871-'72 proposed the formation of a dredged channel 200 feet wide and 13 feet deep through Choctaw Pass and Dog River bars for a distance of 9 miles, '71, 559; '72, 592; '73, 692; '74, i, 891.

From 1870 to 1878, inclusive, \$411,000 was appropriated and applied to this project. In 1879 Capt. Damrell proposed the deepening of the channel to 17 feet at mean low water at an estimated cost of \$320,000, '79, 100; '80, 1062.

The Board of Engineers of 1880 recommended, that if such a depth will satisfy shipping interests, it be attained by dredging the present channel, '80, 1065; '82, 1246. Subsequent modifications in widths and direction at two points, '82, 1247.

Surveys.

Of harbor, 1878, '80, 1052.

Of channel, 1885, '85, 1338.

Examination, 1884, for 23-foot channel, '85, 1374.

MAPS.

'80, 1066; '84, 1158.

MOCCASON RIVER, N. C. (See CONTENTNEA CREEK, N. C.)**MOKELUMNE RIVER, CAL.—IMPROVEMENT OF.****Appropriations.**

1884.....	\$8,500, '85, 2359.
1886.....	2,500, '86, 1924.
1888.....	2,000, act of August 11, 1888.

Commerce.

Productions of adjacent country, '82, 2640.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 324; '82, 318; '85, 362; '86, 355; '87, 321.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Mendell, 1881-'85. Reports, '82, 2637; '87, 2441.

Capt. A. H. Payson, 1885. Reports, '85, 2358; '86, 1924.

ASSISTANTS.

C. D. Rhodes. Report, '82, 2639.

Lieut. S. W. Roessler. Report, '85, 2359.

Operations.

1884-'85. 160 snags and 314 overhanging trees removed between Benson's Ferry and Snodgrass Slough, '85, 2358.

1885-'86. 718 snags, logs, and trees removed from the same channel, '86, 1925.

1886-'87. 174 snags and 183 trees cut and removed, '87, 2441.

Physical Characteristics.

Description of river and its obstructions, '82, 2639.

Projects.

By Lieut. Col. Mendell, 1881, for improvement of river between Benson's Ferry and Snodgrass Slough, a distance of 10 miles, by removal of snags, logs, and similar obstructions, and also excavation of shoals near the mouth of the Cosumnes River. Estimated cost, \$8,250, '82, 2639.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1881, under direction of Lieut. Col. Mendell, '82, 2637.

MONONGAHELA RIVER, PA. AND W. VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 345.)

Appropriations.

1872-'79.....	\$187,000.00	
1880.....	25,000.00,	'80, 1764.
1881.....	25,000.00,	'81, 1945.
1882.....	25,000.00,	'82, 1931.
1884.....	45,000.00,	'84, 1721.
1886.....	90,900.00,	'86, 1542.
Total	397,900.00	
1888.....	35,000.00 }	act of August 11, 1888.
	*161,733.13 }	

Commerce.

Value and importance of the works of the Monongahela Navigation Company, '87, 1802, 1805.

Contracts.

1881. Shipman & Carmody, for stone, '81, 1944.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 193; '81, 261; '82, 256; '83, 263; '84, 262; '85, 282; '86, 273; '87, 238, 239.

BOARD OF ENGINEERS.

Convened at Pittsburgh December 21, 1886, by S. O. No. 112, C. of E., to report upon commercial value and importance of works of Monongahela Navigation Company. Report, '87, 1802. (Majs. King, Stickney, and Mackenzie.)

MONONGAHELA RIVER, PA. AND W. VA.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Lieut. Col. W. E. Merrill, 1872-'— Reports, '80, 1763; '81, 1943; '82, 1929; '83, 1548; '84, 1699, 1701; '85, 1813, 1817; '86, 1542, 1543; '87, 1800-1809.

ASSISTANT.

L. M. Petitdidier. Report, '85, 1816.

Operations.

1879-'80. Lock and Dam No. 9, completed, '80, 1763.

1880-'82. No operations, '81, 1943; '82, 1929.

1882-'83. Cofferdam built for Lock No. 8, foundations for lock-wall, cross-wall at lock-head, and 32 linear feet of wing-wall built, '83, 1548.

1883-'84. No operations for lack of funds, '84, 1699. Care and operation of Lock and Dam No. 9, '84, 1701.

1884-'85. 5,460 cubic yards masonry placed in Lock No. 8, completing the lock, with the exception of lower wing-wall, '85, 1813. Care and operation of Lock and Dam No. 9, '85, 1817.

1885-'86. No operations on river for lack of funds, '86, 1542. Care and operation of Lock and Dam No. 9, '86, 1543.

1886-'87. Wing-wall of Lock No. 9 completed to a height of 14 feet above lower mitre-sill, '87, 1800. Care and operation of Dam No. 9, '87, 1809.

Private and Corporate Work.

Works built by the Monongahela Navigation Company, statements and estimates of their value, '87, 1802.

Projects.

The original project by Maj. Merrill in 1872 proposed continuing a 6-foot slack-water navigation from Geneva to Morgantown, a distance of 18½ miles, by the construction on the part of the United States of two locks and dams, Nos. 8 and 9, the former at Dunkard Creek, the latter at Hounds Rocks; and the construction on the part of the Monongahela Navigation Company of Lock and Dam No. 7, '73, 504. (See also index to Reports of Chief of Engineers, Vol. I, p. 346.)

From 1872 to 1886, inclusive, \$397,900 had been appropriated, when the cost to complete was estimated at \$30,376, '86, 1542.

Report by Board of Engineers, 1886, upon the commercial value and importance of the works built by the Monongahela Navigation Company, '87, 1802-1808.

MONROE HARBOR, LA.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 227.

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '84, 1381, 1383.

ASSISTANT.

F. S. Burrows. Report, '84, 1383.

Plans.

By Maj. Miller, 1883, for protection of caving banks, at estimated cost of \$10,000, '84, 1383.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Maj. Miller, '84, 1381.

MONROE HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 347.)

Appropriations.

1835-'79	\$209,515.27
1880	2,000.00, '80, 2092.
1881	1,000.00, '81, 2290.
1882	1,000.00, '82, 2379.
1886	2,000.00, '86, 1849.

Total	215,515.27
1888	5,000.00, act of August 11, 1888.

MONROE HARBOR, MICH.—Continued.**Contracts.**

1880. W. Richardson, for dredging, at 11 cents per cubic yard, '80, 2092.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 223; '81, 303; '82, 298; '83, 306; '84, 308; '85, 332; '86, 326; '87, 294.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2083; '81, 2279; '82, 2377.

Maj. L. C. Overman, 1883-'— Reports, '83, 1837; '84, 2081; '85, 2209; '86, 1847; '87, 2281.

Operations.

History of operations from 1828-'80, '80, 2083.

1879-'80. 12,370 cubic yards material, and 53 logs, snags, and piles removed from channel, '80, 2090.

1880-'81. Extensive repairs to piers, '81, 2280.

1881-'82. 600 linear feet revetment renewed and 600 additional feet strengthened; also repairs to south pier, '82, 2378.

1882-'83. 1,733 linear feet old revetment of United States canal and north and south piers repaired, '83, 1888.

1883-'84. Extensive repairs to north and south piers; 798 linear feet United States revetment repaired, '84, 2082.

1884-'86. No operations, '85, 2210; '86, 1848.

1886-'87. Extensive repairs to piers and revetment, '87, 2282.

Projects.

The earliest improvement was proposed in 1826, by Capt. T. W. Maurice, and provided for the construction of a breakwater in La Plaisance Bay. Under an aggregate of \$19,713.96 this work was completed in 1835, '80, 2085. (See also index to Reports of Chief of Engineers, Vol. I, p. 278.)

In 1834, Capt. H. Smith proposed the straightening of Raisin River at its mouth, by making a direct connection with Lake Erie, through a sand peninsula, by a canal 4,000 feet long and 100 feet wide, and the protection of the entrance by parallel piers extending to the 10-foot curve in the lake, '80, 2085.

From 1835-'82, inclusive, \$213,515.27 had been appropriated, when it was estimated that \$20,000 would be required to complete project, '82, 2379; '86, 327.

MOOSE-A-BEC RIVER at Jonesport, Me.—IMPROVEMENT OF.

(Continued from Vol. I, p. 349.)

Appropriations.

1881.....	\$10,000, '81, 462.
1882.....	10,000, '82, 490.
1884.....	10,000, '84, 463.
1886.....	10,000, '86, 534.

Total 40,000

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '87, 439.

Commerce.

Benefit resulting from proposed improvement of, '81, 462.

Contracts.

G. C. Fobes & Co., for dredging, at 32 cents per cubic yard, '82, 490.

Moore & Wright, for dredging, at 42 cents per cubic yard, '83, 412.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 71; '81, 65; '82, 64; '83, 60; '84, 68; '85, 56; '86, 55; '87, 15.

ENGINEERS IN CHARGE.

Col. G. Thom, 1879-'83. Reports, '80, 358; '81, 461; '82, 488.

Col. C. E. Blunt, 1883-'86. Reports, '83, 410; '84, 462; '85, 465.

Maj. J. A. Smith, 1886-'— Report '86, 533; '87, 438.

ASSISTANT.

A. C. Both. Report, '80, 359.

Operations.

1881-'82. 27,346 cubic yards material dredged, '82, 480.

1882-'83. No operations, '83, 411.

MOOSE-A-BEC RIVER—Continued.**Operations—Continued.**

18-3-'84. 20,983 cubic yards material dredged, '84, 462.

1884-'85. No operations, '85, 466.

1885-'86. 23,345 cubic yards material dredged, completing the dredged channel over the bar, '86, 533.

1886-'87. Preparation for removal of Steam-boat Ledge, '87, 439.

Plans.

By Maj. Smith, 1886, for widening channel, breakwater and beacon construction, and removal of rock ledges. Estimated cost, \$45,000, '86, 534. For formation of channel, 300 feet wide and 16 feet deep at mean low water, by dredging and rock removal. Estimated cost, \$110,000, '87, 439.

Projects.

By Col. Thom, 1880, for formation of channel through Moose-a-bec Bar, 200 feet wide and 14 feet deep at mean low water, by dredging and rock removal. Estimated cost, \$28,000, '80, 362. Increased, 1881, to \$40,000, '82, 489; '85, 465.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Col. Thom, '80, 359.

MAPS.

'80, 358; '85, 466.

Moose-a-bec Bar, '86, 534.

MOREHEAD CITY, N. C.—EXAMINATION OF SOUND NEAR.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 177.

ENGINEER IN CHARGE.

Capt. J. Mercur, 1883. Report '84, 1062.

Plans.

Capt. Mercur states that the examination of this locality might be included in that of one of the neighboring sounds not yet examined, and therefore submits no opinion as to the necessity for its improvement, '84, 1063.

Surveys.

Examination ordered by letters of August 11 and September 27, 1882, '84, 1062.

MOSQUITO CREEK, between the South Edisto and Ashepoo rivers, with a view to connect the South Edisto with the Ashepoo at or near Fenwick's Island, S. C.

Examination ordered by act of August 5, 1886, '87, 154.

MOSQUITO LAGOON, FLA. (See INDIAN RIVER, FLA.)

MOUNT DESERT, ME. (See BAR HARBOR, ME.)

MOUNT VERNON CHANNEL, POTOMAC RIVER. (See POTOMAC RIVER AT MOUNT VERNON.)

MUDDY RIVER, KY. (See GREEN, MUDDY, AND BARREN RIVERS, KY.)

MURDER-KILL CREEK, DEL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 126.

ENGINEER IN CHARGE.

Capt. W. Ludlow. Report, '82, 817.

ASSISTANT.

E. A. Gieseler. Report, '82, 819.

Physical Characteristics.

Creek described, '82, 819.

Plans.

By Capt. Ludlow, 1882, for improvement of entrance to creek and dredging between Webb's Landing and mouth to obtain a low-water channel 4 feet deep. Estimated cost, from \$72,000 to \$89,000, '82, 818.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Ludlow, '82, 817.

MUSCATINE, IOWA. (See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)**MUSCLE SHOALS, TENN.—CANAL AT.**

(See TENNESSEE RIVER.)

MUSKEGON HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 351.)

Appropriations.

1867-'79	\$149,000
1880	7,500, '80, 2018.
1881	20,000, '81, 2218.
1882	25,000, '82, 2306.
1884	20,000, '84, 1984.
1886	12,500, '86, 1765.

Total..... 234,000

1888..... 45,000, act of August 11, 1888.

Contracts.

1879. Dewar & Corlett, materials and labor, '80, 2018.

1881. J. W. Dennis, for pier construction, '81, 2218.

1882. Gillen & Kirby, for pier construction and dredging, the latter at 40 cents per cubic yard, '83, 1822. McGraft & Montgomery, for timber, '83, 1820. J. B. Smith & Co., for cedar bark, '83, 1820. Michigan Barge Company, for stone, '83, 1820. Keepers & Riddell, for iron, '83, 1820.

1884. H. B. Herr, for pier extension, '85, 2078.

1886. T. W. Kirby, for stone, at \$8.15 per cord, '86, 1765. Kelley, Maus & Co., for iron, '86, 1765. A. H. Petrie, for timber, '86, 1765.

1887. Schwarz & Berner, for pier construction, '87, 2191.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 216; '81, 293; '82, 288; '83, 295; '84, 297; '85, 319; '86, 313; '87, 281.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80. Report, '80, 2007.

Maj. F. Harwood, 1880-'82. Reports, '80, 2017; '81, 2216.

Maj. D. P. Heap, 1882-'83. Report, '82, 2305.

Capt. D. W. Lookwood, 1883-'—. Reports, '83, 1820; '84, 1963; '85, 2077; '86, 1764; '87, 2189.

MUSKEGON HARBOR, MICH.—Continued.**Operations.**

- 1879-'80. North pier extended 50 feet, '80, 2017.
 1880-'81. Repairs to piers and construction of catch-sand fences, '81, 2216.
 1881-'82. 150 linear feet crib-work in extension of north pier, '82, 2305.
 1882-'83. Break in end of south pier repaired; 115 linear feet superstructure rebuilt on pile pier; 3 cribs completed to the 16th course, '83, 1821.
 1883-'84. 100 linear feet crib-work sunk in extension of detached portion of north pier; 250 linear feet south pier superstructure rebuilt, '84, 1953.
 1884-'85. Superstructure on detached portion of north pier built; 100 linear feet crib-work in extension of detached portion of north pier, '85, 2077.
 1885-'86. Breaks in south pier-head and channel wall repaired; pile-work refilled, '86, 1764.
 1886-'87. End of old north pier repaired by hired labor; crib construction in extension of north pier commenced, '87, 2189.

Projects.

By Maj. Wheeler, 1866, for extension of harbor piers, by crib-work, to 17-foot curve. Estimated cost, \$58,450, '66, iv, 145, 146; '79, 1617. Amended in 1879 to \$168,901.75, '79, 1616; '81, 2217; '86, 1765, '87, 2190. Modified in 1880 to increase the width of entrance from 190 to 300 feet by a detached north pier, '86, 1764; '87, 2189. From 1867 to 1884, inclusive, \$221,500 had been appropriated, when it was estimated that \$113,625 would be required to complete project, '84, 1984.

Surveys.**MAPS.**

'82, 2306; '84, 1984.

MUSKINGUM RIVER, OHIO—CONSTRUCTION OF ICE-HARBOR AT MOUTH OF.

(Continued from Vol. I, p. 353.)

Appropriations.

1879.....	\$30,000
1880.....	50,000, '80, 1790.
1881.....	30,000, '81, 1951.
1882.....	40,000, '82, 1937.
1884.....	30,000, '84, 1703.
1886.....	37,500, '86, 1546.
Total	237,500
1888.....	60,000, act of August 11, 1888.

Contracts.

1880. T. B. Townsend, for dimension stone, '80, 1790.
 1882. S. G. Sprague, for round timber, '82, 1937. W. H. Ewing & Co., for square timber, '82, 1937.
 1884. Marietta Chair Company, for timber, '85, 1822. Dawes, Irish & Co., for round piles, at 12 cents per linear foot, '85, 1822.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 194; '81, 262; '82, 257; '83, 264; '84, 263; '85, 283; '86, 274; '87, 240.

ENGINEER IN CHARGE.

Lient. Col. W. E. Merrill, 1871-'—. Reports, '80, 1789; '81, 1949; '82, 1934; '83, 1555; '84, 1703; '85, 1821; '86, 1546, '87, 1813.

ASSISTANT.

W. Weston. Report, '85, 1823.

Legislation.

Immediate action under appropriation of 1879 prevented by legal difficulties, '80, 1789.

Operations.

- 1879-'80. 549 cubic yards dimension stone and 1,280 cubic yards rubble delivered, '80, 1790.
 1880-'81. Cofferdam built; upper end of lock extended 40 feet into bank, '81, 1950.
 1881-'82. 2,587 cubic yards dimension stone and the same quantity of rubble delivered; 5,500 cubic yards material excavated; foundation piles driven; 9,000 square feet lock floor and 2,700 cubic yards concrete and masonry laid, '82, 1936.

MUSKINGUM RIVER, OHIO—Continued.**Operations—Continued.**

1882-'83. 2,600 cubic yards material excavated; piles driven; 1,350 square feet lock floor and 1,099 cubic yards concrete and masonry laid; 2 lock-gates hung, '83, 1556.

1883-'84. No operations from lack of funds, '84, 1703.

1884-'85. 11,080 cubic yards material excavated; foundation piles driven; 4,855 cubic yards concrete and masonry laid, '85, 1824.

1885-'86. No operations for lack of funds, '86, 1546.

1886-'87. Stone cutting for lock masonry in progress; failure of masonry on part of the work through action of cement used, '87, 1814.

Projects.

By Lieut. Col. Merrill, 1879, for construction of an ice-harbor by means of a lock and dam, admitting boats from the Ohio River to the Muskingum; lock 400 feet in length between mitre-sills, and 56 feet wide; new masonry inlet to mill-race; extending dam through present lock, and construction of new dam bridge, also dredging below lock. Estimated cost, \$216,400, '79, 1365; '80, 1790; '83, 265.

Increased, 1883, to \$246,000, '83, 265, 1557.

Increased, 1885, to \$296,000, '85, 1821.

Surveys.**MAPS.**

'85, 1824.

MUSKINGUM RIVER, OHIO—IMPROVEMENT OF AND OPERATION OF LOCKS AND DAMS ON.

(Continued from Vol. I, p. 353.)

Appropriations.

1886..... \$20,000, '86, 1548.

1888..... 102,000, act of August 11, 1888.

Commerce.

Commercial statistics, '86, 1553, 1562.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 265; '86, 274, 275, 279; '87, 240.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1886-'— Reports, '86, 1547, 1548, 1551, 1552; '87, 1815.

ASSISTANTS.

J. B. Gregory. Report, '86, 1556.

Lieut. L. H. Beach. Report, '87, 1820.

Legislation.

Act of the State of Ohio, ceding to the United States the locks and dams on the Muskingum River, '86, 1564.

The act of August 5, 1886, provides for the acceptance from the State of Ohio of the locks and dams on the Muskingum River built by the State, '86, 1547; '87, 1815.

Operations.

1885-'86. Survey of river made, '86, 1547, 1548.

1886-'87. Locks and dams ceded to the United States and taken possession of on April 7, 1887; progress on repair of works, '87, 1817, 1818, 1820.

Private and Corporate Work.

Locks and dams between Zanesville and Dresden built by State of Ohio at a cost of \$1,500,000, '86, 1552, 1554, 1557, 1561; '87, 240.

Condition of work when turned over to the United States, '87, 1817, 1820.

Projects.

The locks and dams on the Muskingum River ceded to the United States by act of Ohio legislature, '86, 1564. Accepted by the United States in act of August 5, 1886, '86, 1547; '87, 1815, 1817.

In 1886 Lieut. Col. Merrill considered that \$200,000 would be required to repair the State locks and dams between Zanesville and Marietta, '86, 1553.

In 1887 a more detailed examination of the works indicated that the locks and dams would require more extensive repairs than anticipated in 1886, '87, 1817, 1820.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Merrill, '86, 1551.

NANSEMOND RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 353.)

Appropriations.

1873-'79 \$37,000
 1888 10,000, act of August 11, 1888.
 List of appropriations, '80, 820.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 118; '87, 123.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'80. Report, '80, 820.

Capt. F. A. Hinman, 1887-'— Report, '87, 995, 1001.

ASSISTANT.

H. J. Gieloo. Report, '87, 1002.

Operations.

1879-'80. 1,120 linear feet of dike built; further operations not required, '80, 820.

Plans.

By Capt. Hinman, 1887, for excavation of a channel, by dredging, 100 feet wide and 12 feet deep at mean low water, from head of navigation to mouth of Western Branch, including a turning basin at Suffolk Bridge; spur-dam and training-wall construction, also for a channel of same length and from 200 to 400 feet wide, from Town Point to Western Branch, by dredging and training-wall construction. Estimated cost, \$152,500, '87, 1001.

Projects.

By Maj. Craighill, 1872, for channel 100 feet by 8 feet by removal of obstructions, dredging, and dike construction. Estimated cost, \$20,000, '72, 723. Increased by S. T. Abert, U. S. Agent, in 1878, to \$37,000, '78, 541. Completed in 1880, '80, 820.

Surveys.

Ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Hinman, '87, 1001.

MAPS.

'87, 1002.

NANTICOKE RIVER, DEL. AND MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 354.)

Appropriations.

1886 \$10,000, '87, 843.
 Previous appropriations have been for Broad Creek, Del., '87, 842.

Contracts.

1887. F. C. Somers, for dredging, at 11½ cents per cubic yard, '87, 842.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 110; '87, 94.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1879. Report, '80, 740.

W. F. Smith, U. S. Agent, 1887-'—. Report, '87, 842.

ASSISTANT.

J. L. Seager. Report, '80, 74.

Operations.

1886-'87. Dredging began under contract, '87, 842.

Project.

Lieut. Col. Craighill considers that as there is not less than 8 feet at low water in the main river from the Forks to Seaford no improvement is at present necessary, '80, 742. The appropriation of August 5, 1886, was to be applied to extending the 5-foot low-water navigation to Laurel, '87, 842.

Physical Characteristics.

Description of river from Forks to Seaford, '80, 741.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Lieut. Col. Craighill, '80, 740.

NANTUCKET HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 354.)

Appropriations.

1828-'79	\$45,834.75
1880	50,000.00, '80, 365.
1881	25,000.00, '81, 541.
1882	25,000.00, '82, 549.
1884	10,000.00, '84, 596.
1886	15,000.00, '86, 589.

Total	170,834.75
-------------	------------

1888	20,000.00, act of August 11, 1888.
------------	------------------------------------

Contracts.

1880. J. Scully, for riprap granite, at \$1.87 per ton, '81, 540.
 1882. C. H. Edwards, for riprap, \$2.37 to \$2.57 per ton, '83, 469.
 1885. C. H. Edwards, for riprap granite, at \$1.96 per ton, '86, 590.
 1886. J. A. Bouker, for riprap granite jetty construction, '87, 536.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72, 76; '81, 78, 541; '82, 78; '83, 73; '84, 79; '85, 64, 579; '86, 68.

BOARD OF ENGINEERS.

Convened at New York, August 23, 1880, to consider the project of Gen. Warren for improvement of Nantucket Harbor. Reports, '81, 542. (Cols. Tower and Newton.)

Convened at New York July 17, 1885, to report upon further prosecution of adopted project for improvement and upon location and plan for eastern jetty. Report, '85, 576. (Col. Duane and Lieut. Col. Comstock.)

ENGINEERS IN CHARGE.

- Lieut. Col. G. K. Warren, 1874-'82. Reports, '80, 365, 423; '81, 540; '82, 548.
 Maj. J. W. Barlow, 1882-'83. '83, 468.
 Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 468; '84, 593; '85, 561, 564; '86, 567.
 Maj. W. R. Livermore, 1887-'—. Report, '87, 536.

Operations.

- History of previous plans and operations for harbor improvement, '80, 435.
 1880-'81. 3,989 tons granite placed in jetty, making a total length of 860 feet, '81, 540.
 1881-'82. 8,134 tons granite placed in jetty, making a total length of 1,650 feet; 6 spurs built on Coatue Point, '82, 548, 549.
 1882-'83. 9,223 tons stone placed in jetty, completing the work to a length of 2,894 feet, '83, 469.
 1883-'84. 7,713 tons stone placed in jetty, completing the work to a length of 2,894 feet, '83, 469. 7,713 tons stone delivered in jetty, extending the same 440 feet, '84, 594.
 1884-'85. 4,986 tons granite riprap placed in extension of jetty, '85, 562.
 1885-'86. 2,000 tons stone placed in jetty, making a total length of 3,955 feet, '86, 588.
 1886-'87. 250 tons stone placed in jetty, '87, 535.

Plans.

- By Lieut. Col. Warren, 1880, for experimental channel through Hanlover Beach 10 feet wide and 2 feet deep; estimated cost, \$1,200. For channel 100 feet wide and 6 feet deep; estimated cost, \$32,000, '80, 436.
 By Lieut. Col. Elliot, 1885, for location of east jetty, '85, 564-576.
 Plan submitted to Board of Engineers, 1885. Report, '85, 576-579.

Projects.

- Between 1828 and 1832 \$45,834.75 was appropriated, which was expended in ineffectual dredging, '75, ii, 376; '80, 435.
 In 1880 Lieut. Col. Warren proposed the formation of a harbor of refuge by the extension of a west jetty of random stone about 4,000 feet long from near Bug Light on Brant Point. Should a second or east jetty be required it should extend from Coatue Beach. Estimated cost of western jetty, \$112,000; for both jetties, \$224,000. Estimate of Board of Engineers, \$236,000, '80, 433; '81, 543; '82, 549.
 Recommended by Board of Engineers, 1880, '81, 542-545. Concurred in by the Chief of Engineers, '81, 542.

NANTUCKET HARBOR, MASS.—Continued.**Projects—Continued.**

In 1885, the western jetty having been nearly completed to its proposed length, the question of the location of east jetty was submitted to a Board of Engineers, which recommended the curvature to the westward or the further extension of the west jetty; the construction of the east jetty parallel to the west jetty at its outer end and distant about 1,000 feet therefrom, thence connecting by a curve with outer beach, recourse to be had to dredging where the scour does not result in a channel depth of 15 feet, '85, 576-579.

Amount appropriated from 1880 to 1886, inclusive, \$125,000; estimated cost for completion of project, \$250,000, '86, 69, '87, 536.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Lieut. Col. Warren, '80, 423.

Full survey of outer harbor made, 1882, '82, 548.

Survey of area east of western jetty and within the harbor, '84, 594.

Maps.

'80, 423, 427; '85, 576, 578.

NAPA RIVER, CAL.—SURVEY FROM MOUTH TO NAPA CITY.

[\$7,500 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 360.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '85, 2343.

ASSISTANT.

L. J. Le Conte. Report, '85, 2346.

Physical Characteristics.

Description of river, '85, 2344.

Plans.

By Lieut. Col. Mendell, 1888, for the formation, by dredging and removal of obstructions, of a 4-foot low-water channel. Estimated cost, \$27,000, '85, 2346.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Mendell, '85, 2343.

NARRAGANSETT BAY (GREAT), R. I. (See PROVIDENCE RIVER AND NARRAGANSETT BAY.)**NARRAGANSETT BAY (LITTLE), R. I. AND CONN.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 355.)

Appropriations.

1876-79.....	\$20,000
1880.....	5,000, '80, 394.
1881.....	5,000, '81, 565.
1882.....	6,000, '82, 564.

Total.....36,000

Contracts.

1879. J. McDermott, for dredging, at 23½ cents per cubic yard. '80, 393.

1880. W. H. Beard, for dredging, at 18 cents per cubic yard, '81, 564.

1882. Hartford Dredging Company, for dredging, at 21 cents per cubic yard, '83, 498.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 75; '81, 86; '82, 86; '83, 83; '84, 89; '85, 78; '86, 78; '87, 41, 43.

NARRAGANSETT BAY (LITTLE), R. I. AND CONN.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Lieut. Col. G. K. Warren, 1875-'83. Reports, '80, 392; '81, 564; '82, 563.

Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 496; '84, 629; '85, 615; '86, 613; '87, 571.

Maj. W. R. Livermore, 1887-'— Report, '87, 561.

Operations.

History of work, '80, 392.

1879-'80. 17,935 cubic yards material dredged from channel, '80, 393.

1880-'81. 8,092 cubic yards material dredged from channel, '81, 564.

1881-'82. 33,686 cubic yards material dredged from channel, 25 rocks removed by hired labor from east entrance of new channel, and 57 bowlders removed at Watch Hill, '82, 563.

1882-'83. 20,867 cubic yards material dredged from channel, completing improvement as projected, '83, 496.

1883-'84. 100 bowlders removed from main and Watch Hill channels, '84, 629.

1884-'87. No operations; project completed, '86, 614; '87, 561.

Plans.

In 1886 Lieut. Col. Elliot did not consider the channel leading to Watch Hill wharves as worthy of improvement, '87, 572.

Projects.

By Maj. Warren, 1876, for excavation of channel 200 feet wide and 7½ feet deep at mean low water, extending across the north shore of the bay from Pawcatuck Point to deep water near the mouth of the bay at Sandy Point; also removal of dangerous rocks in channel near Rhodes Folly and Watch Hill. Estimated cost, \$51,000, '76, i, 221; '80, 392; '86, 78.

Project completed in 1884, '86, 78, 614; '87, 561.

Surveys.

Examination of entrance to wharves at Watch Hill ordered by act of August 5, 1886. Made under direction of Lieut. Col. Elliot, '87, 571.

NARRAGUAGUS RIVER, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 356.)

Appropriations.

1871-'79..... \$22,000

1886..... 10,000, '87, 441.

1888..... 10,000, act of August 11, 1888.

Contracts.

1-'87. Moore & Wright, for dredging, at 16 cents per cubic yard, '87, 442.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72; '81, 77; '87, 15.

ENGINEERS IN CHARGE.

Col. G. Thom, 1870-'81. Report, '81, 535.

Maj. J. A. Smith, 1887-'— Report, '87, 441.

ASSISTANT.

A. C. Both. Report, '81, 536.

Operations.

1886-'87. Dredging commenced under contract, '87, 441.

Projects.

By Col. Thom, 1880, for dredging channel 200 feet wide and 11 feet deep, low water, from deep water off Turner's Point to deep water off Fickett's Point. Estimated cost, \$50,000, '81, 535.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Thom, '81, 535.

NASSAU RIVER AND FERNANDINA, FLA.—INSIDE PASSAGE BETWEEN.

(See SAINT JOHN'S RIVER.)

NATALBANY RIVER, LA.—EXAMINATION OF.

(See also TICFAW RIVER, LA.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 216; '85, 226.

ENGINEERS IN CHARGE.

Maj. A. Stickney. Report, '84, 1289.

Capt. T. Turtle. Report, '85, 1446.

ASSISTANTS.

H. C. Collins. Report, '84, 1296.

C. D. Anderson. Report, '85, 1446.

Plans.By Maj. Stickney, 1884, for removal of obstructions from 10 miles of river channel.
Estimated cost, \$1,800, '84, 1290; '85, 1446.**Surveys.**

Examination ordered by act of August 2, 1882. Made under direction of Maj. Stickney, '84, 1289.

NATCHEZ, MISS. (See MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF THE PASSES.)**NEABSCO CREEK, VA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 357.)

Appropriations.

1881..... \$5,000, '81, 948.

Contracts.

1881. National Dredging Company, for dredging, at 15½ cents per yard, '82, 1007.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 117; '81, 152; '82, 146; '83, 152; '84, 155; '85, 144; '86, 140; '87, 106.

ENGINEER IN CHARGE

S. T. Abert, U. S. Agent, 1880.— Reports, '81, 947; '82, 1606; '83, 796; '84, 980; '85, 962; '86, 901; '87, 928.

Operations.

History of operations, '82, 1006.

1881-'82. 23,613 cubic yards material dredged from the channel, '82, 1008.

1882-'87. No operations, '83, 796; '84, 980; '85, 962; '87, 928.

Physical Characteristics.

Description of Neabasco Creek, '81, 947.

Projects.

By S. T. Abert, 1881, for excavation of channel 100 feet wide and 7 feet deep, from 7-foot curve in the Potomac River to Atkinson's Upper Landing, a distance of 14,800 feet, including a channel to Atkinson's Lower Landing and Willie's Wharf. Estimated cost, \$55,924, '81, 948.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of S. T. Abert, '81, 947.

NEBRASKA CITY, NEBR. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**NECHES RIVER, TEX.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 357.)

Appropriations.

1878-'79	\$13,000
1880	5,000, '80, 1202.
1881	3,000, '81, 1325.

NECHES RIVER, TEX.—Continued.**Appropriations—Continued.**

1882..... \$5,000, '82, 1425.
 1884..... 7,000, '84, 1257.

Total 33,000

Statement of appropriations, '82, 1425; '87, 1384.

Contracts.

1881. Neyland & Henderson, for removal of obstructions, '81, 1324.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 147, 150; '81, 198; '82, 195; '83, 200; '84, 208; '85, 225; '86, 222; '87, 186.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1880-'81. Reports, '80, 1201; '81, 1324.

Capt. C. E. L. B. Davis, 1881-'82. Report, '81, 1324.

Maj. W. H. Heuer, 1882-'84. Reports, '82, 1425; '83, 1057.

Capt. T. Turtle, 1884-'85. Report, '84, 1256.

Maj. W. H. Heuer, 1885-'—. Reports, '85, 1426; '86, 1288; '87, 1384.

ASSISTANT.

J. S. Polhemus. Report, '80, 1202.

Operations.

1881-'82. River improved between Yellow Bluff and Bevilport, by removal of snags, logs, and similar obstructions, '82, 1425.

1882-'87. No operations, '83, 1058; '84, 1256; '85, 1427; '86, 1288; '87, 1384.

Physical Characteristics.

General description of river, '80, 1203.

Projects.

By Capt. C. W. Howell, 1878, for dredging a channel 40 feet wide and 5 feet deep at mean low water across the bar at the mouth of the Neches River. Estimated cost, \$26,318, '78, '84, '80, 1202.

By Maj. Mansfield, 1880, for removal of snags, trees, and similar obstructions from Yellow Bluff to Bevilport, a distance of 7 miles. Estimated cost, \$15,000, '80, 1204.

Aggregate estimates for projects of 1878-'80, \$41,318, '87, 1384.

Surveys.

Survey from mouth to Bevilport ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Mansfield, '80, 1202.

NEHALIM BAY AND RIVER, OREG.—EXAMINATION OF ENTRANCE TO.

(Continued from Vol. I, p. 358.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 368; '87, 330.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Reports, '85, 2409; '87, 2496.

ASSISTANTS.

P. G. Eastwick. Report, '85, 2411.

Lieut. E. Burr. Report, '87, 2497.

Physical Characteristics.

Description of locality, '85, 2410.

Plans.

In 1884 Capt. Powell did not consider the entrance to the bay and river worthy of improvement, '85, 2411; '87, 2497.

Surveys.

Examination ordered by acts of July 5, 1884, and August 5, 1886. Made under direction of Capt. Powell, '85, 2409; '87, 2496.

NEUSE RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 358.)

Appropriations.

1878-'79	\$35,000
1880	45,000, '80, 843.
1881	30,000, '81, 1005.
1882	35,000, '82, 1087.
1884	20,000, '84, 1038.
1886	22,500, '86, 962.

Total..... 237,500

1888..... 15,000, act of August 11, 1888.

Appropriations previous to 1888, '80, 842.

Commerce.

Increase in traffic due to improvement, '83, 852.

Contracts.

1885. B. W. Canaday, for lumber and iron, '85, 1066.

1886. B. W. Canaday, for lumber and iron, '87, 1023. J. S. Mundy, for hoisting engine, at \$1,060, '87, 1023.

Engineers.**CHIEF OF ENGINEERS.**

Reports '80, 123; '81, 163; '82, 158; '83, 165; '84, 169; '85, 166; '86, 162; '87, 126.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'81. Report, '80, 841.

Capt. J. Meunier, 1881-'84. Reports, '81, 1007; '82, 1086; '83, 850.

Capt. F. A. Hinman, 1884-'85. Reports, '84, 1037.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1065; '86, 979; '87, 1020.

ASSISTANT.

B. Ransom. Reports, '80, 843; '81, 1005; '82, 1087; '83, 851; '84, 1038; '85, 1066; '86, 962; '87, 1024.

Operations.

History of improvement, '86, 962.

1879-'80. 31 miles of river above Kinston cleared of logs, snags, and obstructions; blockade of Linkfield Channel above New Berne removed; river cleared for 22 miles below Kinston; two steam hoisters constructed and nine sheet-pile jetties averaging 100 feet in length built below Kinston, '80, 841, 842.

1880-'81. Snags, logs, and obstructions removed from river for a distance of 12 miles above Goldsborough; 5,000 linear feet brush and log jetties built between Pitch Kettle and Deer Neck; two pile and log dams built of 600 feet length, '81, 1004.

1881-'82. 20 miles of upper river between Goldsborough and Smithfield cleaned of snags and obstructions; bank protection and 14,550 linear feet plank jetty built on Lower Neuse; channel connecting Neuse and Trent dredged to 660 feet length, 100 feet width, and 9 feet depth, '82, 1086.

1882-'83. Work of clearing the river completed to Smithfield; 3,812 linear feet of jetties built between Kinston and "Becton's Old Field," '83, 850, 851.

1883-'84. 246 logs and stumps removed; 4,450 linear feet jetty constructed, '84, 1038.

1884-'85. 121 jetties (12,402 linear feet) built and 214 logs and snags removed, '85, 1065.

1885-'86. 41 jetties (3,896 linear feet) built; 1,125 feet of old jetty work and 167 logs and snags removed, '86, 981.

1886-'87. 1,767 linear feet of pile and plank jetty completed; 6,725 logs, trees, stumps, and similar obstructions removed, '87, 1022, 1024.

Projects.

The projects of 1871-'83 proposed the removal of obstructions placed in the river during the civil war, and the removal of logs and snags; also the contraction of the channel-way so as to secure during the entire year an unobstructed 8-foot navigation for 40 miles to New Berne, a 4-foot navigation for 50 miles further to Kinston, and during 9 months of the year a 3-foot navigation 108 miles further to Smithfield, '79, 93, 704, 705; '85, 166; '86, 979, 983; '87, 1020.

Total amount appropriated from 1878 to 1886, inclusive, was \$237,500, when \$142,000 was estimated as cost for completing project, '86, 981, 982; '87, 1023.

Surveys.

MAPS.

'80, 842.

NEW ALBANY HARBOR, IND., and river and shores adjacent—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 284.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1884. Report, '85, 1829.

ASSISTANT.

Lieut. G. W. Goethals. Report, '85, 1829.

Plans.

Lieut. Col. Merrill, 1884, reports the locality as unworthy of improvement from a commercial stand-point, '85, 1829.

Surveys.

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Lieut. Col. Merrill, '85, 1829.

NEW BEDFORD HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 359.)

Appropriations.

1836-'79 \$37,691.37

1888 10,000.00, act of August 11, 1888.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 73; '87, 43.

ENGINEER IN CHARGE.

Lieut. Col. G. K. Warren, 1874-'80. Report, '80, 371.

Operations.

The improvement of this harbor was completed in 1878 at a cost of \$20,000, and no further work is contemplated, '78, 227; '80, 73.

Surveys.

Examination ordered by act of August 5, 1886, '87, 43.

NEW BERNE TO BEAUFORT, N. C.—IMPROVEMENT OF INLAND LINE OF NAVIGATION BETWEEN, VIA CLUBFOOT, HARLOWE, AND NEWPORT RIVERS.

Appropriations.

1882 \$10,000,* '84, 1040.

1886 10,000, '86, 985.

1888 15,000, act of August 11, 1888.

Commerce.

Justification of the improvement, '87, 1027, 1028, 1030.

Contracts.

1884. T. P. Morgan, for dredging, at the rate of \$4.98 per hour, '85, 1070. Annulment of contract, '85, 1071, 1073; '86, 986.

1886. R. Moore, for dredging, at 33 cents per cubic yard, '87, 1029.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 171, 177; '85, 167; '86, 163; '87, 127.

ENGINEERS IN CHARGE.

Capt. F. A. Hinman. Report, '84, 1040.

Capt. J. Mercur. Report, '84, 1065, 1067.

Capt. W. H. Bixby, 1884— Reports, '85, 1070; '86, 983; '87, 1026.

ASSISTANTS.

J. P. Darling. Report, '84, 1068.

R. Ransom. Reports, '85, 1074; '86, 985; '87, 1029.

E. D. Thompson. Report, '87, 1029.

Operations.

1884-'85. 1,500 cubic yards dredged from channel in Harlowe Creek, '85, 1070, 1073.

1885-'86. Operations suspended, '85, 1073; '86, 984, 986. History of work, '86, 985.

1886-'87. Removal of logs and stumps from upper end of Harlowe Creek, '87, 1027, 1029.

*Derived from appropriations from Neuse River and Beaufort Harbor, N. C., '84, 1040.

NEW BERNE TO BEAUFORT, N. C.—Continued.**Physical Characteristics.**

Route described, '84, 1065, 1068.

Plans.

By Capt. Phillips, 1880, as part of a water route south from Norfolk, Va., '80, 857-897; '84, 1066.

By Capt. Mercur, 1883, for the formation of a channel 80 feet wide and 9 feet deep, from New Berne to Beaufort, via the Clubfoot River, Clubfoot and Harlowe Canal, Harlowe and Newport rivers. Estimated cost, from \$480,000 to \$883,000, '84, 1067-1071.

Private and Corporate Work.

Work done by the New Berne and Beaufort Canal Company, '87, 1028.

Projects.

The project of 1885 proposed the formation of a dredged channel 30 feet wide and 5 feet deep, from New Berne to Beaufort, via Clubfoot, Harlowe, and Newport rivers, a distance of 42 miles, at an estimated cost of \$92,000, '85, 1074; '86, 984; '87, 1027.

Surveys.

Earliest surveys, '80, 857-897; '84, 1066. Ordered by act of August 2, 1882. Made under the direction of Capt. Mercur, 1883, '84, 1065, 1067.

MAPS.

'80, 896.

NEW BUFFALO HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 360.)

Appropriations.

1852-'79 \$78,000
1882..... 5,000, '82, 263.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 213; '81, 289; '82, 293; '83, 291; '84, 293; '85, 322.

ENGINEERS IN CHARGE.

Maj. J. A. Smith, 1879-'85. Reports, '80, 2006; '81, 2195; '82, 2272, 2273, 2278; '83, 1803; '84, 1969.

Capt. D. W. Lockwood, 1885-'—. Report, '85, 2087.

ASSISTANTS.

O. L. Petitdidier. Report, '82, 2276.

Capt. J. A. Manning. Report, '84, 1970.

Operations.

Operations suspended from 1872 to 1881.

1881-'82. Outer pier section removed to low-water level; oak piling replaced in position and 20 new piles driven; new timber superstructure completed; repairs to other portions of pier, '82, 2273.

1882-'83. No operations, '83, 1803.

1883-'84. East entrance pier extended 100 linear feet by close piling and crib superstructure, '84, 1969, 1970.

1884-'85. Pier extension completed, '85, 2087.

Plans.

By Maj. Smith, 1881, for formation of harbor of refuge by construction of 3,500 linear feet of breakwater and 3,000 linear feet of piers from shore. Estimated cost, \$300,000, or if covered with superstructure and parapet of masonry, \$970,000, '82, 2275. Or, by deepening a portion of the swamp and creek, and connecting the harbor thus made with the lake by a channel 300 feet wide, protected by piers. Estimated cost, \$650,000, '82, 2276.

By Maj. Smith, 1881, harbor improvement, by extension of east pier 500 feet and west pier 600 feet, also 1,000 linear feet of channel revetment and dredging. Estimated cost, \$150,500, '82, 2279.

Projects.

The original project was adopted in 1857 and proposed the formation of a channel 200 feet wide and 12 feet deep through the sand-bank between Lake Michigan and Lake Pottawatomie, '67, 102. The project was partially carried out in 1868, when a Board of Engineers recommended its abandonment, '68, 223; '85, 322.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Maj. Smith, '82, 2273.

NEWBURYPORT HARBOR, MASS.—IMPROVEMENT OF.

(See also MERRIMAC RIVER.)

Appropriations.

1880.....	\$50,000, '80, 346.
1881.....	40,000, '81, 503.
1882.....	40,000, '82, 509.
1884.....	40,000, '84, 497.
1886.....	37,500, '86, 560.

Total..... 207,500

1888..... 25,000, act of August 11, 1888.

Between 1828 and 1834, inclusive, \$60,366.72 were appropriated for the removal of a sand-bar and the construction of a breakwater at the mouth of the Merrimac River.

Contracts.

1881. E. P. Shaw, for granite grout, at \$1.32 per ton, '81, 504.

1883. I. Hamilton and S. Teague, for dike construction, '83, 435. T. A. Rowe and R. G. Sylvester, for sheet-piling, '83, 436.

1886. T. C. Rowe, for sand-catch fence construction, at \$2.67 per running foot, '87, 490. C. H. Edwards, for stone, at \$2.23 per ton, '87, 490.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 69; '81, 72, 504; '82, 71; '83, 66; '84, 73; '85, 60; '86, 60; '87, 22.

BOARD OF ENGINEERS.

Convened at New York October 4, 1880, to report upon project by Gen. Thom for improvement of Newburyport Harbor. Report, '81, 505. (Cols. Tower and Newton and Lieut. Col. Abbot.)

ENGINEERS IN CHARGE.

Col. G. Thom, 1871-'83. Reports, '80, 345; '81, 501, 507; '82, 509.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 433, 436; '84, 493, 497, 498, 499; '85, 494.

Lieut. Col. G. L. Gillespie, 1886-'—. Reports, '86, 557; '87, 489.

Operations.

For operations previous to 1881, see MERRIMAC RIVER.

1881-'82. 30,366 tons rubble-stone placed in jetty, extending the same a distance of 1,200 feet, '82, 509.

1882-'83. 17,800 tons rubble-stone placed in work, extending the dike 340 feet; 817 linear feet of diking completed across "the basin;" 507 linear feet of sheet-piling constructed in south jetty shore extension at Plumb Island, '83, 434.

1883-'84. Dike across basin at Plumb Island completed with exception of central portions; stone extension of Smith Jetty at Plumb Island completed and jetty finished to 1,077 feet; 468 linear feet catch-sand fence built, '84, 494.

1884-'85. 33,008 tons rubble placed in work extending north jetty cove 2,640 linear feet, and south jetty cove 1,300 linear feet, '85, 494.

1885-'86. North jetty cove extended 35 feet; south jetty leveled up throughout its length; 540 linear feet catch-sand fence built, '86, 558.

1886-'87. 860 linear feet of pile-dike built; 7,937 tons stone delivered in extension of north jetty, '87, 490.

Physical Characteristics.

Decrease in width of bar since commencement of jetties, '85, 496. Comparison of gorge and discharge sections from various surveys, '85, 496. Discharge of river, '87, 491.

Projects.

From 1828 to 1834, inclusive, \$60,366 were appropriated for the removal of a sand-bar at the mouth of the Merrimac River and for the construction of a breakwater.

By Lieut. Col. Thom, 1880, for securing a constant depth of 17 feet across bar at mean low water by construction of two converging rubble-stone jetties, extending from Salisbury Bend and Plumb Island; also stone protection at Plumb Island. Estimated cost, \$365,000, '81, 502, 509, 511. Recommended by Board of Engineers, '81, 505. Concurred in by Chief of Engineers, '81, 505.

In 1881 a dike closing Plumb Island Basin was proposed, increasing the cost of the project to \$375,000, '84, 494.

In 1883 the project was modified by changing the direction of south jetty and substituting for the apron beach protection a sand catch in rear and in prolongation of south jetty, '83, 437; '86, 60; '87, 490.

NEWBURYPORT HARBOR, MASS.—Continued.**Surveys.**

Of area from gorge between Salisbury Point to Plumb Island, to jetties, and in front of jetties to 15-foot curve, '86, 559.

Of outer bar and harbor entrance, 1880, '81, 501.

Maps.

'81, 502; '83, 438; '84, 496; '85, 494; '86, 558; '87, 492.

NEW CASTLE, DEL.—ICE-HARBOR AT.

(Continued from Vol. I, p. 362.)

Appropriations.

1826-'79	\$211,468.99
1880	3,000.00, '80, 585.
1881	20,000.00, '81, 768
1884	2,000.00, '84, 816.
1886	5,000.00, '86, 859.

Total..... 241,468.99

1888..... 7,500.00, act of August 11, 1888.

List of appropriations, '86, 859; '87, 830.

Contracts.

1880. American Dredging Company, for dredging, at 15 cents per cubic yard, '80, 585.

1882. F. Pidgeon, jr., for ice-pier construction, '82, 756.

1887. National Dredging Company, for dredging, at 12 cents per cubic yard, '87, 829.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 94; '81, 121; '82, 120; '83, 119; '84, 128; '85, 128; '86, 125; '87, 88.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 584; '81, 768.

Capt. W. Ludlow, 1882-'83. Report, '82, 755.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 617.

Maj. W. H. Hener, 1884-'85. Report, '84, 816.

W. F. Smith, U. S. Agent, 1885-'— . Reports, '85, 872; '86, 858; '87, 829.

ASSISTANT.

W. P. Smith. Reports, '85, 874.

Operations.

1879-'80. 17,000 cubic yards material dredged; old wreck near Pier "H" removed; 100 cubic yards riprap placed along outer face of outer pier; repairs to piers, '80, 584.

1880-'81. No operations, '81, 768.

1881-'82. Crib-work construction under contract nearly completed, '82, 756.

1882-'83. Work in accordance with project completed, '83, 618.

1886-'87. 30,015 cubic yards material dredged and piers repaired and riprapped, '87, 829.

Projects.

By Col. Macomb, 1881, for construction of one additional pier and dredging. Estimated cost, \$23,000, '81, 768.

By W. F. Smith, 1884, for removal and reconstruction of Pier "H," repairs to Pier "K," and dredging. Estimated cost, \$20,600, '85, 875, 876; '86, 126.

Surveys.**MAPS.**

'87, 830.

NEW HARBOR, IND.—EXAMINATION OF RIVER IN VICINITY OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 284.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1829.

NEW HARBOR, IND.—Continued.**Engineers—Continued.****ASSISTANT.**

G. W. Goethals. Report, '85, 1829.

Plans.

In 1884 Col. Merrill did not consider the locality worthy of improvement, '85, 1829.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. Merrill, '85, 1829.

NEW HAVEN, CONN.—CONSTRUCTION OF BREAKWATER AT.**Appropriations.**

1879.....	\$30,000
1880.....	30,000, '80, 449.
1881.....	60,000, '81, 595.
1882.....	60,000, '82, 612.
1884.....	40,000, '84, 648.
1886.....	75,000, '86, 640.

Total	295,000
1880.....	75,000, act of August 11, 1886.
Statement of appropriations, '87, 603.	

Commerce.

Commerce of the sound, '81, 597.

Contracts.

1880. F. H. Smith, riprap granite, 89 cents per ton, '80, 455. J. Beattie, riprap granite, at 81 cents per ton, '81, 596. Arnold & Stevens, riprap granite, at 84 cents per ton, '81, 596.
1881. J. P. Stanton, riprap granite, at \$1.13 per ton, '82, 612.
1882. F. K. Ballou, for breakwater construction, at \$1.14 per ton, '83, 516. J. A. Bouker, riprap, at \$1.15 per ton, '83, 516.
1886. T. J. Allen, for granite riprap, at \$1.12 per ton, '87, 604.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 78, 449; '81, 92; '82, 92; '83, 89; '84, 95; '85, 84; '86, 84; '87, 47.

BOARD OF ENGINEERS.

Convened at New York November 29, 1879, to report upon projects submitted by Maj. Barlow for a breakwater at entrance to New Haven Harbor, Conn. Report, '80, 450. (Cols. Tower and Newton and Maj. Abbot.)

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 448, 452; '81, 594; '82, 611.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 514; '84, 647; '85, 646.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 639; '87, 602.

ASSISTANT.

H. B. Gorham. Reports, '80, 456; '81, 596; '82, 613.

Operations.

- 1879-'80. 5,976 tons granite riprap placed in breakwater, extending it 70 feet, '81, 594.
- 1880-'81. 64,392 tons granite riprap delivered and 620 linear feet of breakwater built, '81, 594.
- 1881-'82. 49,500 tons riprap granite delivered and breakwater extended 535 feet, '82, 611.
- 1882-'83. 13,097 tons riprap delivered, adding 153 feet to the breakwater, '83, 515.
- 1883-'84. 34,903 tons riprap delivered and 439 linear feet of breakwater built, '84, 647.
- 1884-'85. 28,006 tons riprap delivered and 330 linear feet of breakwater built, '85, 647.
- 1885-'86. No operations, '86, 639.
- 1886-'87. 22,643 tons of granite delivered in east breakwater, extending the same 265 feet, '87, 603.

Plans.

By Maj. Barlow, 1879, for four different sites for a breakwater, '80, 452-455. Considered by Board of Engineers, 1879, '80, 450. See **PROJECTS**.

NEW HAVEN BREAKWATER, CONN.—Continued.**Projects.**

By Board of Engineers, 1879, for formation of a harbor of refuge for vessels of 20 feet draught by construction of two breakwaters of riprap granite, one extending from Southwest Ledge in a northeasterly direction to Quix's Ledge, a distance of 3,300 feet, the average height being 32 feet. The other beginning at Ludington's Rock with a westerly direction and a length of 4,200 feet, and average height of 28 feet; width at the top, 12 feet; height above high-water plane, 6 feet. Total estimated cost of East and West breakwaters, \$1,311,134, '80, 448-450; '87, 602.

Surveys.**MAPS.**

'82, 610; '84, 646.

NEW HAVEN HARBOR, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 353.)

Appropriations.

1852-'79	\$171,000
1880	15,000, '80, 445.
1881	15,000, '81, 593.
1882	30,000, '82, 609.
1884	10,000, '84, 646.
1886	20,000, '86, 637.
Total	261,000
1888	15,000, act of August 11, 1888.

Statement of appropriations, '82, 609; '87, 600.

Contracts.

1879. H. N. & A. J. Beardsley, for dredging, at 9½ cents per cubic yard, '80, 446.
 1880. Morris & Cummings, for dredging, at 12½ cents per cubic yard, '81, 593.
 1881. H. N. & A. J. Beardsley, for dredging, at 11½ cents per cubic yard, '82, 609.
 1882. D. V. Howell, riprap dike, at \$1.37 per ton, '83, 514. A. M. Newton, pile and stone dike, at \$21.83 per linear foot, '83, 514.
 1885. H. Du Bois & Sons, for dredging, at 8½ cents per cubic yard, '86, 638.
 1886. J. Roddin, for extension of dike, '87, 601.
 1887. O. J. Conley, for riprap dike extension, at \$1.03 per ton, '87, 601.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 77; '81, 91; '82, 92; '83, 88; '84, 94; '85, 83; '86, 84; '87, 46.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 444; '81, 591; '82, 607.
 Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 512; '84, 645; '85, 644.
 Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 636; '87, 597.

ASSISTANT.

W. A. Peck, Report, '80, 447.

Operations.

- 1879-'80. 125,890 cubic yards material dredged from channel, '80, 444.
 1880-'81. 129,110 cubic yards material dredged from channel, '81, 591.
 1881-'82. 117,400 cubic yards material dredged, completing a 16-foot low-water channel, with a width of from 440 feet below Long Wharf to 600 feet at bend opposite the same, '82, 608.
 1882-'83. 1,575 tons granite delivered and 600 linear feet dike built; also 100 feet pile dike completed and 350 feet partially completed, '83, 512.
 1883-'84. 2,094 tons granite delivered and 694 linear feet riprap dike built; damage to latter repaired and barrel beacons placed on channel ends, '84, 645.
 1884-'85. No operations, '85, 645.
 1885-'86. Old piers at Tomlinson's Bridge and portion of east abutment of same removed; 64,192 cubic yards material dredged from channel area above and below the bridge, '86, 636, 637.
 1886-'87. Channel arm of dike extended 515 feet, and log and riprap ice-breaker built, '87, 598.

Physical Characteristics.

Description of New Haven Harbor and its surroundings, '86, 636.

NEW HAVEN HARBOR, CONN.—Continued.**Projects.**

The earliest project for the expenditure of the appropriation of \$6,000 in 1852 seems to have been for the removal of Middle Rock, '66, 1, 7, 37, which was in progress in 1866-'67, '67, 44, 451.

The project of 1870 proposed the formation of a dredged channel 13 feet at low water up to the city wharves, '71, 85, 769-775. In 1871, '72, '75, '77 the project was modified so as to provide for a channel 16 feet deep above Fort Hale Bar, '72, 861; '75, ii, 249-251; '77, 212; '79, 336.

In 1879 it was proposed to increase the depth over Fort Hale Bar by the construction of a dike from Sandy Point, '79, 338.

From 1852-'86, inclusive, \$251,000 was appropriated, when it was estimated that \$80,000 would be required to complete the project, '86, 637.

In 1887 the estimates for Sandy Point dike and dredging through Fort Hale Bar were revised; required \$93,000 to complete existing project, '87, 600.

Surveys.

Borings made in bar below Fort Hale, 1880, '81, 592.

Examination of channel, 1882, '82, 604.

MAPS.

'82, 610; '84, 646; '85, 644.

NEW LONDON HARBOR, CONN.—IMPROVEMENT OF.**Appropriations.**

1880.....	\$2,500, * '80, 586.
1881.....	4,300, '81, 587.
1882.....	9,000, '82, 601.
1884.....	2,000, '84, 638.
1886.....	2,000, '86, 634.

Total 19,800

Contracts.

1880. W. Flannery, for dredging, at \$1.87 per cubic yard, '81, 588.

1882. J. H. Fenner, for dredging and removal of bowlders, the former at 49 cents per cubic yard and the latter at \$5.50 per ton, '83, 507.

1885. E. Brainard, for dredging, at 39 cents per cubic yard, and removal of bowlders at \$3.90 per cubic yard, '85, 642.

1886. R. M. Payne, for dredging sand, at 40½ cents per cubic yard, and bowlders at \$3.98 per cubic yard, '87, 586.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 90; '82, 90; '83, 86; '84, 92; '85, 82; '86, 83; '87, 44.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1881-'83. Reports, '81, 586; '82, 600.

Lient. Col. W. McFarland, 1883-'86. Reports, '83, 506; '84, 638; '85, 641.

Lient. Col. D. C. Houston, 1886-'— . Reports, '86, 632; '87, 585.

Operations.

1880-'81. 1,222 cubic yards material dredged from shoal east of railroad wharf, '81, 586.

1881-'82. 140 tons bowlders and 6,619 cubic yards stone and sand removed from shoal, '82, 600.

1882-'83. 636 tons bowlders and 9,794 cubic yards sand and stone removed, '83, 506.

1883-'84. No operations, '84, 638.

1884-'85. 2,725 cubic yards sand and gravel dredged; 132 cubic yards bowlders removed, '85, 642.

1885-'86. No operations, '86, 633.

1886-'87. 2,542 cubic yards sand and 45 cubic yards bowlders removed from shoal, '87, 586.

Projects.

By Maj. Barlow, 1878, for removal of sand and boulder shoal in New London Harbor, lying east of the New London Northern Railroad wharf to a depth of 16 feet at mean low water. Estimated cost \$6,800, '78, 397. Afterward increased on account of difficulty in excavation to \$24,000, '81, 586; '86, 632, 633; '87, 585.

Surveys.**MAPS.**

'85, 642.

*From Thames River appropriation, '80, 586; '87, 586.

NEW ORLEANS HARBOR, LA. (See MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF THE PASSES.)

NEW ORLEANS, LA.—BREAKWATER AT.

(Continued from Vol. I, p. 366.)

Commerce.

Requirements of, '82, 1390, 1393.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 146; '81, 197; '82, 193.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '82, 1390.

ASSISTANT.

H. C. Collins. Report, '82, 1391.

Plans.

By Maj. Stickney, 1882, for the construction of a breakwater in two sections, in front of new canal entrance, and in front of Bayou St. John's entrance. Estimated cost, \$280,000, '82, 1390.

Private and Corporate Work.

Old breakwater built in 1872 by city of New Orleans, '82, 1390, 1392.

Surveys.

Ordered by act of March 3, 1879, '80, 146. Made under direction of Maj. Stickney, 1882, '82, 1390.

NEWPORT HARBOR, CAL. (See also SAN DIEGO HARBOR, CAL.)

Survey ordered by act of August 5, 1886, '87, 320, 2433.

NEWPORT HARBOR, R. I.—IMPROVEMENT OF.

(Continued from Vol. I, p. 366.)

Appropriations.

1873-'79	\$28,500
1881	25,000, '81, 563.
1882	20,000, '82, 561.
1884	20,000, '84, 624.
1886	15,000, '86, 608.

Total 108,500

1888..... 12,000, act of August 11, 1888.

Contracts.

1881. H. E. Du Bois, for dredging, at 11 cents per cubic yard, '81, 562.

1882. E. M. Payn, for dredging, at 19½ cents per cubic yard, '82, 561. J. H. Fenner, for dredging, at 24½ cents per cubic yard, '83, 493.

1884. Hartford Dredging Company, for dredging, at 19 cents per cubic yard, '85, 604.

1886. Hartford Dredging Company, for dredging, at 21½ cents per cubic yard, '87, 557.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 84; '82, 84; '83, 81; '84, 97; '85, 75; '86, 75; '87, 38.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1881-'83. Reports, '81, 562; '82, 560.

Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 493; '84, 623; '85, 603; '86, 606.

Maj. W. R. Livermore, 1887-'— Report, '87, 554.

Operations.

1881-'82. 115,897 cubic yards material dredged from anchorage area, '82, 561.

1882-'83. 130,396 cubic yards dredged from below Long Wharf and from spit south of Goat Island, '83, 493, 494.

NEWPORT HARBOR, R. I.—Continued.**Operations—Continued.**

1883-'84. No operations, '84, 624.

1884-'85. 62,634 cubic yards dredged from various points in the channel, '85, 604.

1885-'86. 20,184 cubic yards dredged from southern harbor entrance, '86, 607.

1886-'87. 56,353 cubic yards dredged, '87, 556.

Projects.

By Lieut. Col. Warren, 1873, and modified in 1883, for improvement of the harbor by dredging the southern entrance to 15 feet at mean low water, and widening the same to a line drawn from the dolphin which marks the spit, clearing the permanent dock at Fort Adams by 100 feet; by excavation of a channel 750 feet wide and 15 feet deep at mean low water around and to the eastward of the buoy marking Goat Island Spit; by excavation of anchorage area to a mean low-water depth of 13 feet; also for excavation of a 10-foot channel south to a point opposite Gas Company's Wharf, and construction of jetties on western shore of Goat Island. Estimated cost, 1873, \$72,000, '73, 964; '82, 561. Estimate of revised project in 1882, \$132,000, '82, 561; '85, 603, 604; '86, 606.

Surveys.**Maps.**

'84, 624; '85, 604.

NEWPORT RIVER, N. C. (See NEW BERNE TO BEAUFORT, N. C., INLAND LINE OF NAVIGATION.)**NEW RIVER AND BEAUFORT HARBOR, N. C.—WATER-WAY BETWEEN.**

(See BEAUFORT HARBOR AND NEW RIVER, N. C.)

NEW RIVER, N. C.—IMPROVEMENT OF.**Appropriations.**

1882..... \$5,000, '83, 865.

1884..... 5,000, '84, 1046.

1886..... 10,000, '86, 993.

Total 20,000

1888..... 3,000, act of August 11, 1888.

Contracts.

1886. R. Moore, for dredging, at 25 cents per cubic yard, '86, 992. R. Moore, for dredging, at 28½ cents per cubic yard, '87, 1041.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 168; '82, 163; '83, 169; '84, 174; '85, 169; '86, 165; '87, 129.

ENGINEERS IN CHARGE.

Capt. J. Mercur, 1881-'84. Reports, '82, 1117; '83, 865.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1046.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1022; '86, 991; '87, 1039.

ASSISTANTS.

J. P. Darling. Report, '82, 1118.

E. D. Thompson. Report, '87, 1041.

Operations.

1885-'86. 34,991 cubic yards material dredged from cut through marsh at Cedar Bush Cove, '86, 992.

1886-'87. No operations, '87, 1040.

Projects.

By Capt. Mercur, 1882, for excavation of a channel 7,000 feet long, 150 feet wide, and 5 feet deep at mean low water through the bar at New River Inlet, connecting the upper river with the ocean. Estimated cost, \$40,000, '82, 1117.

NEW RIVER, N. C.—Continued.**Projects—Continued.**

In 1885 the location of the hitherto proposed channel was slightly changed, '85, 1082; '87, 1040.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. Mercur, '82, 1117.

NEW RIVER, VA. AND W. VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 367.)

Appropriations.

1876-'79	\$42,000
1880	24,000, '80, 677.
1881	24,000, '81, 909.
1882	12,000, '82, 919.
1886	10,000, '86, 1600.

Total 112,000.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 107; '81, 144; '82, 140; '83, 144; '84, 149; '85, 287; '86, 281; '87, 251.

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1873-'— Reports, '80, 676; '81, 904, 909; '82, 912; '83, 699; '84, 928; '85, 1859; '86, 1599; '87, 1925.

ASSISTANTS.

W. P. Smith. Reports, '80, 678; '81, 904; '82, 912; '83, 700; '86, 1600; '87, 1926.
Capt. T. Turtle. Report, '83, 704.

Operations.

History of operations, '80, 676.

1879-'80. Channel 50 feet wide and 2 feet deep at low water excavated from Blue Stone River to War Ford Shoals, '80, 678.

1880-'81. Channel 50 feet wide and 2 feet deep at low water excavated from Hinton Landing to Harvey's Falls, a distance of 18 miles, '81, 907.

1881-'82. Channel of above dimensions excavated for a distance of 26 miles; also 2½ miles of wing-dam and training-wall built, '82, 913-918.

1882-'83. 2,000 cubic yards rock and gravel removed, forming a channel of former dimensions for a distance of 8 miles, '83, 702, 703.

1883-'85. No operations, '84, 928; '85, 1859.

1885-'86. 1,371 cubic yards material dredged in continuation of channel already formed; 1,863 linear feet of wing-dams and sustaining-walls built, '86, 1600.

1886-'87. No operations, '87, 1926.

Projects.

The project of 1877 proposed an improvement from the mouth of Greenbrier River to Lead Mines for keel-boat navigation to depth of 2 feet and width of 30 feet. Estimated cost, \$156,160, '77, 332; '79, 530, 532.

In 1880, \$66,000 having been appropriated since 1876, the project was modified so as to embrace that part of the river between mouth of Wilson's River and Lead Mines, at an estimated cost of \$205,000, '80, 677.

NEW ROCHELLE HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 368.)

Appropriations.

1881	\$20,000, '81, 644.
1882	15,000, '82, 667.

[Balance to be applied as per project of 1881; act of August 11, 1888.]

Statement of appropriations, '87, 627.

Contracts.

1881. E. R. Seward, for dredging and rock removal, '82, 668.

NEW ROCHELLE HARBOR, N. Y.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 108; '82, 105; '83, 98; '84, 105; '85, 88; '86, 89; '87, 53.

ENGINEERS IN CHARGE.

Col. J. Newton, 1880-'84. Reports, '81, 643; '82, 666; '83, 547.

Capt. J. Mercur, 1884-'85. Report, '84, 709.

Lieut. Col. W. McFarland, 1885-'86. Report, '85, 661.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 654; '87, 626.

ASSISTANTS.

R. H. Talcot. Report, '81, 645.

Lieut. G. McC. Derby. Report, '84, 711.

Operations.

1881-'82. Channel 100 feet wide, 6 feet deep, and 1,500 feet long dredged around Glen Island, '82, 666.

1882-'83. No operations, '83, 547.

1883-'84. Removal of "Corning Rock" to a least depth of 12 feet at mean low water completed, '84, 710.

1884-'87. No operations, '85, 660; '86, 654; '87, 626.

Projects.

By Col. Newton, 1881, for excavation of a channel 100 feet wide and 8 feet deep at mean low water around south end of Glen Island; also formation of approaches to Glen Island and Flat Island by removal of "Corning Rock" to 12 feet and rock "C" to a depth of 9 feet low water, and the removal of part of a reef at the entrance of the dredged channel. Estimated cost, \$40,825, '81, 645; '86, 654; '87, 626.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Col. Newton, '81, 644.

Examination of channel dredged in 1881, '86, 654.

MAPS.

'82, 654, 666.

NEWTON CREEK, N. J.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 129; '82, 126; '84, 139.

ENGINEER IN CHARGE.

Capt. W. Ludlow. Report, '82, 805.

Plans.

In 1882 Capt. Ludlow considered that on account of the permanent bridges near the mouth, no improvement of the stream could be attempted, '82, 805.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Ludlow, '82, 805.

NEWTOWN CREEK, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 368.)

Appropriations.

1880..... \$10,000, '80, 510.

1882..... 15,000, '82, 663.

1884..... 20,000, '84, 727.

1886..... 37,500, '86, 719.

Total..... 82,500

1888..... 25,000, act of August 11, 1888.

Statement of appropriations, '87, 701.

Commerce.

Large trade in oil, '80, 510.

Value of, '83, 562.

NEWTOWN CREEK, N. Y.—Continued.**Contracts.**

1880. W. Flannery, for dredging, at 43 cents per cubic yard, '81, 640.
 1883. H. N. & A. J. Beardsley, for dredging, at 27 cents per cubic yard, '83, 563.
 1884. Atlantic Dredging Company, for dredging, at 23½ cents per cubic yard, '85, 669.
 1887. Morris & Cummings Dredging Company, for dredging, at 32 cents and 34½ cents per cubic yard, '87, 702.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 83; '81, 102; '82, 103; '83, 101; '84, 107, 122; '85, 91; '86, 96; '87, 60.

ENGINEERS IN CHARGE.

Col. J. Newton, 1879-'83. Reports, '80, 509; '81, 638; '82, 661.
 Lieut. Col. G. L. Gillespie, 1883-'85. Reports, '83, 561; '84, 726, 765.
 Lieut. Col. W. McFarland, 1885-'— . Reports, '85, 668; '86, 717; '87, 699.

ASSISTANT.

A. Doerflinger. Report, '84, 767.

Operations.

- 1880-'81. Channel 60 feet wide and 18 feet deep dredged from mouth of creek to Vernon avenue, '81, 638.
 1881-'82. No operations, '82, 662.
 1882-'83. 52,005 cubic yards material dredged from channel at bridge, '83, 561.
 1883-'84. No operations, '84, 726.
 1884-'85. 51,468 cubic yards material dredged from the channel, '85, 669.
 1885-'86. No operations, '86, 718.
 1886-'87. 24,675 cubic yards material dredged, '87, 700.

Projects.

- By Col. Newton, 1880, for improvement of the creek by deepening the channel to form 18 to 21 feet low water and 200 feet wide from mouth to Vernon avenue. Estimated cost, \$44,050, '80, 511; '81, 636; '82, 662; '86, 96.
 By Lieut. Col. Gillespie, 1884, for improvement of creek from Vernon Avenue Bridge to head of navigation by excavation of a channel from 125 to 150 feet wide and with a depth of 18 feet to Central Oil Works, 15 feet to Queens County Oil Works, 12 feet to Nichol's Chemical Works, and 10 feet thence to head of navigation. Estimated cost, \$211,519, or a total of \$255,569, '84, 766; '86, 718; '87, 699.

Surveys.

- Ordered by act of March 3, 1879. Made, 1880, under direction of Col. Newton, '80, 510.
 From mouth to Metropolitan avenue ordered by act of August 21, 1882. Made, 1882, under direction of Maj. Gillespie, '84, 765.

MAPS.

'85, 668.

NEW YORK HARBOR—IMPROVING GEDNEY'S AND MAIN SHIP CHANNELS.

(See, also, BUTTERMILK CHANNEL and STATEN ISLAND AND NEW JERSEY CHANNEL.)

Appropriations.

1884. Improving Gedney's Channel.... \$200,000, '85, 770.
 1886. Improving New York Harbor.... 750,000, '86, 743.
 1888. Improving New York Harbor.... 380,000, act of August 11, 1888.

Commerce.

- Necessity for improvement of channel, '85, 770, 780; '86, 728; '87, 728, 729.
 Tonnage and draught of largest steamers entering port of New York, '85, 778; '86, 728.

Contracts.

1885. R. Stone, for formation of channel by hydraulic dredge, '85, 767, 771. Failure of method employed, '85, 768, 769; '86, 731. E. Brainard, for dredging at Gedney's Channel, at 54 cents per cubic yard, '85, 772; '86, 731.
 1887. Joseph Edwards Dredging Company, for dredging in Gedney's and main channels, at the rate of 28½ cents per cubic yard, '87, 722, 728, 733.

Encroachments.

- Illegal dumping of dredged material and garbage, '86, 728, 739; '87, 724. (See LEGISLATION.)

NEW YORK HARBOR—Continued.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 113, 773; '86, 98; '87, 62.

BOARD OF ENGINEERS.

Convened at New York November, 1880, to consider plan of Mr. H. Knapp for creating permanent channel through Sandy Hook Bar. Report, '81, 676. (Cols. Tower and Newton and Lieut. Col. Abbot.)

Board of Engineers of 1884 convened to consider the improvement of channels of entrance to New York Harbor over the shoal areas across Lower Bay. (See PLANS and PROJECTS.) Report, '85, 783. (Col. Duane, Lieut. Cols. Abbot and Comstock.)

Board of Engineers of 1886 convened to consider the communication of the committee of the New York Chamber of Commerce upon the subject of the permanent improvement of the sea entrance to the harbor of New York. Report, '87, 731. (Cols. Casey and Abbot, Lieut. Cols. Comstock, Houston, and McFarland.)

ENGINEERS IN CHARGE.

Lieut. Col. G. L. Gillespie, 1884-'85. Report, '85, 766.

Lieut. Col. W. McFarland, 1885.—. Reports, '86, 724; '87, 717.

Legislation.

Provisions in act of August 6, 1886, relating to unlawful disposal of garbage and dredged material, '87, 725.

Operations.

1884-'85. Efforts to deepen Gedney's Channel by hydraulic dredge, '85, 768, 769; '86, 731.

1885-'86. 86,706 cubic yards removed from Gedney's Channel, '86, 100, 734; '87, 719.

1886-'87. 217,161 cubic yards removed from Gedney's Channel, '87, 719.

Physical Characteristics.

Description of the lower bay, '86, 724; '87, 717.

Changes in lower bay as determined by comparative surveys, '85, 775, 784; '86, 726, 729.

Tidal observations, '85, 777, 784; '86, 727, 740.

Character of bottom, '86, 837, 739.

Wave action, '86, 741.

Plans.

By H. Knapp, for creating a deep and permanent channel through Sandy Hook Bar by the construction of an artificial bar of stone located outside the natural bar, '81, 679-685.

Plan considered by Board of Engineers, 1880, which concluded that the proposed wall will not improve the navigation over the bar, '81, 679.

By Lieut. Col. Gillespie, 1884, for the formation of a dredged channel through main channel, west of Flynn's Knoll, 1,000 feet wide and 30 feet deep at mean low water. Estimated cost, \$620,000, '85, 779, 786.

By Board of Engineers, 1884, to give 30 feet depth at mean low water from New York to the ocean by the construction of a stone dike running about south-southeast from Coney Island probably about 4 miles, the protection of the head of Sandy Hook, and the dredging of a channel 30 feet deep from the deeper water near Sandy Hook to deep water below the Narrows; also the dredging of a channel 1,000 feet wide and 28 feet deep through the shoal west of Flynn's Knoll, '85, 787; '86, 730.

Projects.

By Lieut. Col. Gillespie, 1884, for the formation, by dredging, of a channel through the shoal in the west end of Gedney's Channel 4,000 feet long, 1,000 feet wide, and 30 feet deep at mean low water, '85, 777. Recommended for approval by Board after reducing proposed depth of channel to 28 feet, '85, 773, 787; '86, 730. Approved by Secretary of War, '85, 774.

Successful results from dredged channel, '87, 63, 720.

The act of August 5, 1886, provides for the formation of channels 30 feet deep at mean low water, '87, 63, 718.

The Board of Engineers of 1886 recommended that the appropriation of \$750,000 made in 1886 be applied wholly in Gedney's and the main ship channels, '87, 720-733.

Surveys.

Of part of lower bay, New York Harbor, made under direction of Lieut. Col. Gillespie, 1884, '85, 766, 778.

Comparison with previous surveys, '85, 775.

MAPS.

Of lower bay, '85, 778; '86, 742.

Of Gedney's Channel, '86, 742.

NIAGARA RIVER—EXAMINATION FROM YOUNGSTOWN TO LAKE ONTARIO.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 352.

ENGINEER IN CHARGE.

Capt. E. Maguire. Report, '85, 2293.

Plans.

In 1884 Capt. Maguire considered that the locality was not worthy of improvement, '85, 2383.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Maguire, '85, 2293.

NIAGARA RIVER at mouth of Tonawanda Creek, N. Y.—IMPROVEMENT OF.**Appropriations.**

1881..... \$5,000, '81, 2426.

1882..... 1,500, '82, 2437.

1888..... 100,000, act of August 11, 1888.

Commerce.

Importance as a lumber port, '81, 2426.

Contracts.

1881. E. J. Hingstons, for dredging mud, clay, and gravel, at 18, 20, and 22 cents per cubic yard, '81, 2426.

Encroachments.

Protest by Tonawanda Lumbermen's Association against deposit by city of Buffalo of dredged material below city water-works crib, claiming that the above material conduced to the shoaling of the up-stream channel, '83, 1936, 1936.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 223; '81, 316, 320; '82, 310; '83, 318; '84, 221; '85, 346; '86, 341; '87, 306-308.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1879-'83. Reports, '81, 2425; '82, 2436.

Maj. H. M. Robert, 1883. Report, '83, 1935.

Capt. E. Maguire, 1883-'86. Reports, '84, 2131; '85, 2268; '86, 1884.

Capt. C. F. Palfrey, 1886. '87, 2343.

Capt. F. A. Mahan, 1886-'—. Report, '87, 2366.

ASSISTANTS.

F. T. Hampton. Report, '81, 2427.

M. Kingsley. Reports, '82, 2437; '83, 1937, 1939.

Operations.

1881-'82. 24,740 cubic yards material dredged from bars at head and middle of Tonawanda Island and mouth of creek, '82, 2436.

1882-'86. No operations, '83, 1935; '84, 2131; '85, 2268; '86, 1884; '87, 2366.

Physical Characteristics.

Description of channel and its obstructions, '81, 2427.

Projects.

By Maj. McFarland, 1881, for improvement of Tonawanda Creek, by excavation of bars at head of Tonawanda Island, mouth of creek opposite Smith & Fassett's Dock, and cutting off point at mouth of Tonawanda Creek. Estimated cost, \$15,000, '81, 2429.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. McFarland, '81, 2426.

Examination between Black Rock and Tonawanda ordered by act of August 5, 1886, '87, 308.

MAPS.

'81, 2426.

NIANTIC RIVER AND HARBOR, CONN.—EXAMINATION OF.

(Continued from Vol. I, p. 370.)

Commerce.

Justification of improvement, '85, 711.

Engineers.

CHIEF OF ENGINEERS.

Reports, '85, 963.

NIANTIC RIVER AND HARBOR, CONN.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Lieut. Col. W. McFarland. Report, '85, 710.

Plans.

By Lieut. Col. McFarland, 1884, for the formation of a dredged channel 100 feet wide and 9 feet deep at low water below the railroad bridge. Estimated cost, \$4,000, '85, 711.

Surveys.

Examination ordered by act of July 5, 1884. Made under the direction of Lieut. Col. McFarland, '85, 710.

NIOBRARA, NEBR.—SURVEY OF.

(See MISSOURI RIVER BETWEEN SIOUX CITY AND FORT BENTON.)

NISHUABOTANA RIVER, IOWA—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 230; '82, 227; '85, 257.

ENGINEER IN CHARGE.

Maj. C. R. Suter. Reports, '82, 1736; '85, 1643.

ASSISTANT.

J. W. Pearl. Report, '82, 1737.

Physical Characteristics.

Description of river, '82, 1737.

Plans.

In 1882 Maj. Suter did not consider that the interests of navigation are concerned in the desired improvement, '82, 1737; '85, 1643.

Surveys.

Ordered by acts of June 14, 1880, and July 5, 1884. Made under direction of Maj. Suter, '82, 1736; '85, 1643.

NOMINI CREEK, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 370.)

Appropriations.

1873-'79	\$23,500
1880	5,000, '80, 760.
1881	2,000, '81, 953.
1882	2,000, '82, 1015.

Total	32,500
1888	5,000, act of August 11, 1888.
Appropriations prior to 1880, '80, 759.	

Contracts.

1879. G. C. Fobes & Co., for dredging, at 29½ cents per cubic yard, '80, 758.
 1880. National Dredging Company, for dredging, at 20 cents per cubic yard, '81, 952.
 1881. National Dredging Company, for dredging, at 15½ cents per cubic yard, '82, 1014.
 1883. H. Birch, for dredging, at 19 cents per cubic yard, '84, 983.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 113, 117; '81, 153, 158; '82, 147; '83, 153; '84, 155; '85, 145; '86, 141; '87, 107.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1874—-. Reports, '80, 757; '81, 951, 954; '82, 1012; '83, 799; '84, 982; '85, 966; '86, 903; '87, 932.

NOMINI CREEK, VA.—Continued.**Operations.**

History of operations, '80, 757; '82, 1012.

1879-'80. 6,500 cubic yards material dredged from bar across the channel, '80, 759.

1880-'81. 21,271 cubic yards material dredged from channel, '81, 953.

1881-'82. 10,002 cubic yards material dredged from inside channel, '82, 1014.

1882-'83. No operations for lack of funds, '83, 799.

1883-'84. 8,986 cubic yards material dredged from channel near Ice-House Point, '84, 983.

1884-'87. No operations for lack of funds, '85, 967; '86, 903; '87, 932.

Physical Characteristics.

Description of river and its soundings, '81, 954.

Projects.

The project of 1872 proposed the dredging of a channel through the bar at the mouth of the creek 50 feet wide and 8 or 9 feet deep, from Nomini Bay to White Oak Point, '73, 75, 774.

In 1879 it was modified to a channel width of 150 feet, '79, 606. From 1873 to 1882, inclusive, \$32,500 was appropriated.

In 1885 it was proposed to increase the channel width to 200 feet, dredge a training channel, and sink a mattress across the false channel under White Oak Point. Estimated cost, \$30,000, '85, 966; '87, 932.

Surveys.

Ordered by act of June 14, 1880. Made, 1891, under direction of S. T. Abert, '81, 954.

Examination of channel near Ice-House Point, 1883, '83, 799.

Maps.

'85, 966.

NOOTSACK RIVER. (See SKAGIT RIVER, WASH.)**NORFOLK HARBOR TO ATLANTIC OCEAN SOUTH. (See WATER COMMUNICATION FROM NORFOLK TO OCEAN.)****NORFOLK HARBOR, VA., and the approaches thereto—IMPROVEMENT OF.**

(Continued from Vol. I p. 373.)

Appropriations.

1876-'79	\$160,000
1880	50,000, '80, 817.
1881	75,000, '81, 988.
1882	75,000, '82, 1073.
1884	25,000, '84, 1029.
1884	*50,000, '85, 1018.
1886	50,000, '86, 962.
1886	*137,500, '86, 957.

Total	622,500
1888	50,000, act of August 11, 1888.
Appropriations prior to 1880, '80, 817.	

Commerce.

Growth of Norfolk commerce, '85, 1009.

Receipts and shipments of cotton for 1885, '86, 953.

Contracts.

1879. Morris & Cumings Dredging Company, for dredging, at 12½ cents per cubic yard, '80, 817.

1890. Pardessus & Anthony, for dredging, at 9½ cents per cubic yard, '81, 988.

1881. T. P. Morgan, for dredging, at 14 cents per cubic yard, '82, 1071.

1882. National Dredging Company, for dredging, at 17 cents per cubic yard, '83, 840.

*Improvement of Norfolk Harbor approach and navy-yard. (\$10,000 appropriated by act of August 11, 1888.)

NORFOLK HARBOR, VA.—Continued.**Contracts—Continued.**

1884. National Dredging Company, for dredging, at 17½ cents per cubic yard, '85, 1010.
 1885. S. P. Ross, for dredging (Norfolk Harbor approach), at 9 cents per cubic yard.
 1886. Morris & Cummings Dredging Company, for dredging, at 15½ cents per cubic yard, '87, 964. E. J. Codd & Co., for construction of steam-tender, '87, 967.
 Morris & Cummings Dredging Company, for dredging, at 13 cents per cubic yard, '87, 967.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 118; '81, 158; '82, 154; '83, 160; '84, 163; '85, 153, 154, 1018, 1019; '86, 143, 149; '87, 114, 115.

BOARD OF ENGINEERS.

Convened at Norfolk, Va., September 2, 1884, by S. O. No. 110, C. of E., to consider a project for improvement of the approach to Norfolk Harbor and United States navy-yard. Reports, '85, 1020, 1021. (Lieut. Col. Craighill, Maj. Hains, and Capt. Hinman.)

Report of U. S. Advisory Board upon establishment of port-wardens' lines in Norfolk Harbor, '85, 1026 (Commodore Truxtun, Capt. Mercur, and C. Boutelle), Convened by S. O. Nos. 110 and 137, to consider the construction of the Pinners Point dike. Report, '87, 974. (Col. Craighill, Lieut. Col. Hains, and Capt. Hinman.)

ENGINEERS IN CHARGE.

- Capt. C. B. Phillips, 1878-'81. Reports, '80, 815; '81, 965.
 Capt. J. Mercur, 1881-'84. Reports, '81, 965; '82, 1070; '83, 837; '84, 1028.
 Capt. F. A. Hinman, 1884-'—. Reports, '84, 1028; '85, 1008, 1011, 1015, 1017, 1026; '86, 951, 956; '87, 963, 969.

ASSISTANT.

G. H. Elliot. Report, '80, 818.

Operations.

Operations prior to 1880, '80, 815.

1879-'80. 540,000 cubic yards material dredged, increasing width of channel from 115 to 265 feet, and cutting off Portsmouth Flats to a depth of 20 feet; 72,995 cubic yards material dredged from channel in Western Branch Bar, '80, 816, 818.

1880-'81. 64,385 cubic yards material dredged and 150 scow loads of debris and ballast removed from vicinity of wharves and Portsmouth Flats; 236,815 cubic yards material dredged from Western Branch and Sewall's Point Bar, '81, 966.

1881-'82. 119,147 cubic yards material dredged from Sewall's Point Bar; 218,466, cubic yards material dredged from East and South branches of Elizabeth River, and from Sewall's Point Bar, '82, 1070, 1071.

1882-'83. 118,191 cubic yards material dredged in completion of Morgan's contract; 424,010 cubic yards material removed from bar opposite Sewall's Point and Eastern Branch, '83, 838, 839.

1883-'84. 137,752 cubic yards material dredged from South Pass, Eastern Branch, and vicinity of Town Point, '84, 1028.

1884-'85. 116,399 cubic yards material dredged from Eastern and Southern branches, '85, 1008.

1885-'86. 469,944 cubic yards material dredged from Elizabeth River channel (Norfolk Harbor approach), '86, 957.

1886-'87. 265,570 cubic yards dredged from Southern Branch, and steam-tender built, '87, 964. 179,992 cubic yards dredged from vicinity of Lambert Point Light, '87, 969.

Projects.

By United States Advisory Board, 1878, for excavation of a channel 25 feet deep at mean low water, and 500 feet wide, from the deep water of Hampton Roads to Norfolk Harbor, and to the Gosport navy-yard above on Southern Branch of the Elizabeth River; also for improvement of the harbor proper by dredging at mouth of Eastern Branch, and by dredging off the fore-slopes of Portsmouth and Berkley flats. Estimated cost, \$378,000, '78, 73, 518; '79, 673; '80, 815.

From 1876 to 1884, inclusive, \$225,000 was appropriated for this work.

In 1885 the project was revised so as to secure a channel 25 feet deep at low water and 500 feet wide by dredging from deep water at Hampton Roads to Norfolk and the navy-yard on the Southern Branch; also a channel on the Eastern Branch 22 feet deep and 300 feet wide at the Norfolk and Western Railroad Bridge, increasing to 700 feet at its mouth. A bulkhead 3,000 feet in length, bounding Berkley Flats, would be built to receive the dredged material and maintain the dredged channel. Estimated cost, \$507,744, '85, 155, 1016.

NORFOLK HARBOR, VA.—Continued.**Operations—Continued.**

By Capt. Hixman, 1886, for improvement of approach to Norfolk Harbor and United States navy-yard, by advancing port-wardens' line from Point Norfolk to Lambert's Point, to 12-foot curve by constructing 4,000 linear feet of diking and dredging channel to 25 feet mean low water. Estimated cost, \$235,600, '85, 1026.

The Board of Engineers of 1887 considered that the Pinner Point Dike should not be built until the port-wardens' line from Lambert's Point becomes an actuality, '87, 974.

Surveys.

Examination of channel through bar at Western Branch and at Portsmouth Flats, 1880, '80, 819.

1885. Of harbor from Point Norfolk to United States navy-yard on Southern Branch, and to Campestella Bridge over the Eastern Branch, '85, 1008.

MAPS.

Mouth of Elizabeth River, '80, 816.

Portsmouth Flats, '80, 816.

Elizabeth River, Eastern Branch, '82, 1072.

Eastern branch of harbor, '85, 1008.

Norfolk Harbor approach, '85, 1026; '87, 970.

Southern Branch, '87, 966.

NORTHEAST RIVER, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 374.)

Appropriations.

1872..... \$10,000
1880..... 5,500, '80, 622.

Commerce.

Information as to, '81, 853.

Contracts.

1880. J. Van Patten, for dredging, at 24 cents per cubic yard, '81, 853.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 99; '81, 130; '82, 128; '83, 132.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1872-'83. Reports, '80, 621; '81, 852; '82, 840; '83, 666.

Operations.

1873-'80. Operations suspended, '80, 621.

1880-'81. 19,876 cubic yards material dredged from the channel, '81, 852.

1881-'82. No operations, '82, 840.

Projects.

The appropriation of \$10,000 in 1872 was expended in dredging a channel 5 feet from the 5-foot curve in the river to the wharves, '73, 71, 759.

By Lieut. Col. Craighill, 1880, for increasing the depth of the existing channel from the 5-foot curve near the river's mouth to the wharf at Northeast, to 6 feet mean low water; also widening the same to 75 feet and enlarging the turning-basin in front of the wharf. Estimated cost, \$5,500, '80, 621.

Surveys.

Examination, 1880, '80, 621.

NORTH FORKED DEER RIVER, TENN. (See DEER RIVER, NORTH AND SOUTH FORKS OF.)**NORTH LANDING RIVER, VA. AND N. C.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 375.)

Appropriations.

1879..... \$25,000
1880..... 15,000, '80, 825.
1881..... 7,500, '81, 995.
1882..... 8,000, '82, 1079.

Total..... 55,500

NORTH LANDING RIVER, VA. AND N. C.—Continued.**Contracts.**

1879. G. H. Ferris, for dredging, at 15½ cents per cubic yard, '80, 825.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 120; '81, 160; '82, 156; '83, 166; '84, 166; '85, 158; '86, 153; '87, 119.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'81. Reports, '80, 824; '81, 993.

Capt. J. Mercur, 1881-'84. Reports, '81, 993; '82, 1078; '83, 844.

Capt. F. A. Hinman, 1884-'— . Reports, '84, 1032; '85, 1035; '86, 960; '87, 984.

ASSISTANT.

G. H. Elliot. Report, '80, 825.

Operations.

1879-'80. 110,000 cubic yards material dredged from three shoals in the river; stumps, logs, and similar obstructions removed, '80, 824.

1880-'81. 64,354 cubic yards material dredged from the channel; removal of obstructions continued, '81, 994.

1882-'83. 13,310 cubic yards material dredged from channel; removal of obstructions, 720 stumps, trees, etc., '82, 1079.

1883-'84. 7,011 logs, stumps, and obstructions removed from channel, '84, 1032.

1884-'85. 497 logs and stumps removed; construction of combined steam-hoister and pile-driver commenced, '85, 1035.

1885-'87. No operations, '86, 962; '87, 984.

Projects.

By Capt. Phillips, 1879, for the formation of a channel 80 feet wide at, and 9 feet deep above, ordinary stage of water for its entire length of 17 miles by straightening upper river at abrupt bends by dredging and by removal of stumps, snags, and similar obstructions. Estimated cost, \$88,000, '79, 691; '80, 824. Not considered susceptible of permanent improvement, '86, 153.

Surveys.

Examination, 1885, '85, 1035.

NORTH RIVER BAR, CURRITUCK SOUND AND COANJOK BAY, N. C. (See CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, N. C.)

NORTH RIVER, MICH.—EXAMINATION OF, BETWEEN ESSEX AND NORTH BRIDGES.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 294.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe, 1886. Report, '87, 2271.

Plans.

Lieut. Col. Poe, 1886, reports, in view of the fact that the whereabouts of the above locality could not be ascertained, that the same is unworthy of improvement, '87, 2271.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Lieut. Col. Poe, '87, 2271.

NORTH RIVER, N. Y. (See HUDSON RIVER.)

NORTH AND SOUTH HERO ISLANDS, LAKE CHAMPLAIN.
(See LAKE CHAMPLAIN.)

NORWALK HARBOR, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 375.)

Appropriations.

1879-'79	\$53, 080
1880	5, 000, '80, 466.
1881	5, 000, '81, 610.
1882	5, 000, '82, 623.
1884	5, 000, '84, 654.
1886	3, 000, '86, 651.

Total	76, 080
1886	28, 000, act of August 11, 1886.
Statement of appropriations, '81, 610; '82, 623; '87, 617.	

Commerce.

Business of South Norwalk requires channel of greater dimensions, '84, 655.

Contracts.

1879. H. N. & A. J. Beardsley, for dredging, at 10, 11, and 38 cents per cubic yard, '80, 467.
1880. H. N. & A. J. Beardsley, for dredging, at 12 and 14 cents per cubic yard, '81, 611.
1881. F. Pidgeon, jr., for dredging, at 17 cents per cubic yard, '82, 623.
1882. J. McDermott, for dredging, at 18 cents per cubic yard, '83, 524.
1885. H. N. Beardsley, for dredging, at 9½ cents per cubic yard, '85, 657.
1886. A. J. Beardsley & Son, for dredging, at 11½ cents per cubic yard, '87, 618.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 80; '81, 95; '82, 96; '83, 91; '84, 97; '85, 87; '86, 88; '87, 50.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 465; '81, 609; '82, 622.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 523; '84, 654; '85, 656.

Lieut. Col. D. C. Honston, 1886-'—. Reports, '86, 649; '87, 616.

Operations.

- 1879-'80. 45,519 cubic yards material dredged, '80, 466.
- 1880-'81. 38,083 cubic yards material dredged, '81, 609.
- 1881-'82. 26,159 cubic yards material dredged, '82, 622.
- 1882-'83. 25,003 cubic yards of mud and shells dredged, '83, 523.
- 1883-'84. No operations from lack of funds, '84, 654.
- 1884-'85. 15,464 material dredged from western side of channel, '85, 656.
- 1885-'86. 34,824 cubic yards material dredged, '86, 650.
- 1886-'87. 20,427 cubic yards material dredged from channel above railroad bridge, '87, 617.

Physical Characteristics.

Situation and surroundings of Norwalk Harbor, '85, 656.

Projects.

The project of 1872 proposed the formation of a channel by dredging 100 feet wide and 6 feet deep from the mouth of the river to the Stone Bridge in Norwalk at an estimated cost of \$34,000, '72, 902.

In 1881 the project was modified to admit of a depth of 8 feet below South Norwalk, '81, 609. From 1872 to 1886, inclusive, \$76,000 was appropriated, when, in 1886, it was estimated that \$7,000 would be required to complete project, '86, 650.

Surveys.

Norwalk River, '82, 622.

MAPS.

Norwalk Harbor, '85, 656.

NOTTOWAY RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 376.)

Appropriations.

1880	\$5, 000, '80, 823.
1881	2, 000, '81, 993.

Commerce.

Improvement not followed by any increase in commerce, '83, 844; '86, 159.

NOTTOWAY RIVER, VA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 119; '81, 160; '82, 156; '83, 162; '84, 165; '85, 156; '86, 151; '87, 121.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'81. Report, '80, 823.

Capt. J. Mercur, 1881-'84. Reports, '81, 992; '82, 1077; '83, 843.

Capt. F. A. Hinman, 1884-'— . Reports, '84, 1031; '85, 1033; '86, 961; '87, 966.

Operations.

1881-'82. 2,941 snags, logs, and similar obstructions removed from channel, '82, 1078.

1892-'87. No operations, '84, 1031; '85, 1033; '86, 961; '87, 968.

Projects.

By Capt. Phillips, 1878, for the formation of a channel not less than 60 feet wide and 9 feet deep from the mouth to railroad bridge, and thence to Peter's Bridge, 50 miles above the mouth, 2 feet deep by the removal of logs, snags, and sunken vessels. Estimated cost, \$9,000, '79, 720, 722; '80, 823.

In 1897 Capt. Hinman considered that there was no demand for the completion of the project, '87, 966.

Surveys.

Examination, 1883, '83, 844.

Examination of lower river, '85, 1033.

NOXUBEE RIVER, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 377.)

Appropriations.

1880..... \$12,000, '80, 1093.

1881..... 8,000, '81, 1214.

1882..... 10,000, '82, 1293.

1884..... 7,500, '84, 1214.

1886..... 7,500, '86, 1203.

Total..... 45,000

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '87, 1339.

Commerce.

Estimated value of commerce to be benefited, '81, 1214.

Commencement of traffic after improvement, '83, 1024.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 139, 140; '81, 188; '82, 184; '83, 196; '84, 204; '85, 211; '86, 208; '87, 175.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1879-'—. Reports, '80, 1092, 1093; '81, 1212; '82, 1296; '83, 1022; '84, 1356; '85, 1356; '86, 1201; '87, 1328.

ASSISTANT.

J. P. Fresenius. Report, '80, 1093.

Operations.

1880-'81. 13,416 trees, stumps, and logs removed from channel, carrying the work of improvement over 38 miles of river; one snag and one quarter boat built, '81, 1213.

1881-'82. 13,416 snags, logs, trees, and other obstructions removed, '82, 1296.

1882-'83. 12,827 logs, trees, and snags removed, '83, 1023.

1883-'84. No operations for lack of funds, '84, 1212.

1884-'85. 12,317 trees, logs, snags, and stumps removed, '85, 1357.

1885-'86. 5,188 trees, stumps, and snags removed, making 55 miles of river wholly, and 36 miles partially improved, '86, 1202.

1886-'87. 750 snags, logs, and stumps removed, and 385 trees cut, '87 1329.

Physical Characteristics.

Condition of river and obstructions therein, '80, 1096.

Plans.

In 1887 Maj. Damrell did not consider the river worthy of improvement by locks and dams, '87, 1343.

NOXUBEE RIVER, MISS.—Continued.**Projects**

By Capt. Damrell, 1880, for improvement of river from Macon to its mouth, a distance of 69 miles, by removal of snags, logs, trees, and similar obstructions to navigation. Estimated cost, \$65,245, '80, 1093; '87, 1329, 1343.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Damrell, '82, 1093.

Examination for improvement by locks and dams ordered by act of August 5, 1886.

Made under direction of Maj. Damrell, '87 1343.

MAPS.

'84, 1212.

OAKLAND HARBOR, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 377.)

Appropriations.

1874-'79	\$415,000
1880	60,000, '80, 2231.
1881	60,000, '81, 2464.
1882	200,000, '82, 2529.
1884	139,600, '84, 2179.
1886	60,000, '86, 1910.

Total..... 934,600

1888..... 350,000, act of August 11, 1888.

NOTE.—The appropriation of \$60,000 in 1879 stated as returned to the Treasury, '80, 2229. By subsequent statements of appropriations it does not appear that this occurred.

Contracts.

1880. D. Jordan, for jetty construction, '81, 2464.

1881. J. Hackett, for dredging, at 33 and 38 cents per cubic yard, '81, 2464. Hancock & Kelso, for jetty construction, '82, 2530.

1882. Lorenz & J. Terkelson, for stone, '82, 2530. A. W. Von Schmidt, for dredging, at 19½ cents per cubic yard, '83, 1963.

1884. E. W. Emerson, for jetty construction, '84, 2180. T. Williams, for dredging, at 43 cents per cubic yard, '85, 2330. E. J. Lukens, for dredging, at 12 cents per cubic yard, '85, 2330.

1886. Von Schmidt & McNee, for dredging, at 16 cents per cubic yard, '87, 2423.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 234; '81, 320; '82, 314; '83, 326; '84, 330; '85, 357; '86, 350; '87, 317.

ENGINEER IN CHARGE.

Col. G. H. Mendell, 1875-'— Reports, '80, 2229; '81, 2461; '82, 2527; '83, 1961; '84, 2177, 2183, 2185; '85, 2327; '86, 1907; '87, 2420.

ASSISTANT.

L. J. Le Conte. Reports, '83, 1963; '84, 2180; '85, 2330.

Legal Proceedings.

Opinion of Attorney-General as to rights of United States, '81, 2462.

Legislation.

Provision of act of March 3, 1879, requiring release to title of certain lands, '80, 2229.

Operations.

History of work, '86, 1907.

1879-'80. No operations in consequence of failure to close negotiations with Oakland Water-Front Company, '80, 2229.

1880-'81. 33,900 tons stone delivered in the work, raising the north wall to high-water mark for a distance of 5,700 feet, and south wall to a height of 5 feet above low water for a distance of 9,300 feet; 42,300 cubic yards material dredged from the channel, '81, 2462.

1881-'82. 46,552 tons stone delivered in jetties; 243,735 cubic yards material dredged from the channel, '82, 2529.

1882-'83. 32,351 tons stone delivered in the jetties; 92,055 cubic yards material excavated from channel-way and tidal basin, '83, 1965.

OAKLAND HARBOR, CAL.—Continued.**Operations—Continued.**

1883-'84. 38,903 tons stone delivered and placed in jetty; 503,223 cubic yards material dredged from channel-way and tidal basin, '84, 2178.

1884-'85. 16,685 tons stone delivered in jetties; 59,069 cubic yards material dredged from ship-channel, and 30,047 cubic yards from the tidal basin, '85, 2331.

1885-'86. 696,312 cubic yards material dredged from tidal basin, '86, 1909.

1886-'87. 322,862 cubic yards material dredged, '87, 2420.

Projects.

By Board of Engineers, 1874, to secure a ship-channel entrance 18 to 20 feet deep at low water by the construction of two training-walls extending from the shore to deep water in San Francisco Bay, the formation of a tidal basin at the head of the harbor, and the connection by a canal of the Oakland Estuary with that of San Leandro for the purpose of increasing the tidal basin. Estimated cost, \$1,814,529, '74, ii, 382, 383; '86, 1907; '87, 2419.

Surveys.

Hydrographic survey of entrance and vicinity, '81, 2462.

Examination of channel between the jetties and in front of Oakland, '81, 2462.

Hydrographic survey of entrance, '82, 2529.

OAK ORCHARD HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 378.)

Appropriations.

1836-'79	\$173,000
1880	500, '80, 2206.
1882	3,000, '82, 2444.
1884	5,000, '84, 2136.
1886	12,500, '86, 1886.

Total 194,000

1888 6,000, act of August 11, 1888. |

Appropriations prior to 1880, '81, 2435.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 230; '81, 317; '82, 311; '83, 319; '84, 322; '85, 347; '86, 342; '87, 307.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1875-'83. Reports, '80, 2206; '81, 2435; '82, 2443.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1941; '84, 2136.

Capt. E. Maguire, 1885-'86. Reports, '85, 2270; '86, 1886.

Capt. C. F. Palfrey, 1886, '87, 2369.

Capt. F. A. Mahan, 1886-'—. Report, '87, 2369.

Operations.

1881-'82. 129 linear feet of outer part of east pier leveled up, filled, and redecked; vacant space filled with crib-work; 69 feet of inner part of west pier rebuilt, '82, 2443.

1882-'84. No operations, '83, 1941; '84, 2136.

1884-'85. 1,073 linear feet of west pier superstructure rebuilt and redecked, '85, 2270.

1885-'87. No operations, '86, 1886; '87, 2369.

Projects.

From 1836 to 1880, inclusive, \$173,500 was appropriated and applied to the extension of two piers; dredging in the channel between the piers, and in repairs, '74, i, 343; '76, ii, 579; '80, 2206.

In 1881 Lieut. Col. McFarland proposed the further extension of both lines of pier 500 feet or to the 12-foot curve in Lake Ontario, deepening the channel between the piers to 12 feet, by dredging. Estimated cost, \$100,000, '81, 2435.

OBEIL'S RIVER—FROM THE POINT WHERE IMPROVEMENTS HAVE HERETOFORE BEEN MADE TO THE MOUTH OF THE WEST FORK, TENN.

Examination ordered by act of August 5, 1886, '87, 236.

OBEY'S RIVER, TENN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 380.)

Appropriations.

1880.....	\$4,000, '80, 1888.
1881.....	2,500, '81, 1869.
1882.....	5,000, '82, 1833.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 187; '81, 254; '82, 247; '83, 255; '84, 255; '87, 236.

ENGINEER IN CHARGE.

Maj. W. R. King, 1878-'84. Reports, '80, 1688; '81, 1868; '82, 1853; '83, 1498; '84, 1652.

Operations.

1880-'81. 45 cubic yards solid rock and 1,782 cubic yards gravel and loose rock removed from channel; 1,758 logs, snags, and trees, also removed, '81, 1869.

1881-'82. 691 cubic yards riprap dam built; 2,644 cubic yards loose rock and gravel and 63 cubic yards solid rock removed, '82, 1853.

1882-'83. 63 cubic yards rock and 481 cubic yards gravel excavated, 220 cubic yards stone quarried, and 418 cubic yards riprap dam built, '83, 1499.

1883-'84. 1,516 cubic yards stone quarried; 2,363 cubic yards riprap dam built; 370 cubic yards solid rock and 3,365 cubic yards gravel removed from river; 268 snags removed, completing work of improvement, '84, 1652.

Projects.

By Capt. Overman, 1879, for a 3-foot navigation on the river by dredging and rock excavation, construction of riprap dams, and removal of snags, logs, trees, and similar obstructions. Estimated cost, \$11,869, '79, 1275, 1279. Project completed, '84, 1652.

Surveys.

Examination from point where improvements have been made to the mouth of West Fork ordered by act of August 5, 1886, '87, 236.

OBION RIVER, TENN.—EXAMINATION OF.**Commerce.**

River travel and lumber traffic, '81, 1489.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 213.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyard. Report, '81, 1486.

ASSISTANT.

J. Harrison. Report, '81, 1487.

Physical Characteristics.

Condition of river, 1880, nature of obstructions, and character of surrounding country, '81, 1487, 1488.

Plans.

By Maj. Benyard, 1880, for improvement of Obion River for a distance of 115 miles from its mouth by removing snags, logs, leaning timber, and similar obstructions, thereby securing a least channel depth of 4 feet. Estimated cost (including construction of flat-boat and purchase of outfit), \$28,809, '81, 1487, 1489.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Benyard, '81, 1486.

OCCOQUAN RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 380.)

Appropriations.

1873-'78 \$25,000

Appropriations prior to 1880, '80, 755.

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 112.

1443 EN—24

OCCOQUAN RIVER, VA.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

S. T. Abert, U. S. Agent, 1874-'—. Report, '80, 753.

Operations.

History of operations, '80, 754.

1879-'80. Dredging under contract of 1878 completed; channel through sand-bar below Occoquan redredged; channel 75 feet wide dredged through bar opposite wharves at Occoquan; 876 linear feet of pile dike built; completing operations in accordance with the project for improvement and the demands of commerce, '80, 754, 755.

Projects.

By Lieut. Col. Craighill, 1873, for excavation of channel 100 feet wide and 5 feet deep at low water through the flats "Lower Mud," "Upper Mud," and "Sand Bar." Estimated cost, \$18,000, '73, 820, 825; '80, 754.

In 1875 S. T. Abert proposed the construction of a dike for the improvement of the bar below Occoquan, at a cost of \$5,000, '76, i, 347; '80, 754.

OCKLOCKONEE RIVER, FLA.—SURVEY OF.

(Continued from Vol. I, p. 381.)

Appropriations.

1833..... \$5,000.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 185.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1307.

ASSISTANT.

P. Robinson. Report, '82, 1307.

Physical Characteristics.

Description of river and its obstructions, '82, 1307.

Plans.

By Capt. Damrell, 1881, for improvement of river from mouth to Old River Lake, by removal of snags, logs, and similar obstructions, \$1,000. For improvement above Old River Lake, \$5,000. Improvement not recommended, '82, 1307.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Damrell, '82, 1307.

OCMULGEE RIVER, GA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 382.)

Appropriations.

1876-'79	\$37,000
1880.....	7,000, '80, 1703.
1881.....	5,000, '81, 1876.
1882.....	5,000, '82, 1860.
1884.....	3,000, '84, 1657.
1886.....	7,500, '86, 1160.

Total..... 64,500

1888..... 15,000, act of August 11, 1888.

Commerce.

Benefit of improvement, '80, 1702.

Increase of traffic, '83, 1504.

Contracts.

1887. M. A. Sweeney & Brothers, for snag-boat, '87, 1277.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 189; '81, 256; '82, 250; '83, 257; '84, 257; '85, 199; '86, 198; '87, 167.

OCMULGEE RIVER, GA.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. W. R. King, 1877-'85. Reports, '80, 1701; '81, 1875; '82, 1858; '83, 1503; '84, 1656.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1295; '86, 1159; '87, 1276.

ASSISTANTS.

B. W. Fobel. Reports, '80, 1701; '81, 1876.

C. A. Locke. Report, '82, 1859.

Operations.

1879-'80. 963 snags and 84 trees removed from river-bed; steam derrick-boat built, '80, 1701.

1880-'81. 359 cubic yards rock, clay, and 540 snags removed from channel, '81, 1876.

1881-'82. 921 snags and 1,689 cubic yards material removed and excavated from the channel, '82, 1859.

1882-'83. 90 snags and trees removed; 3 log dams and 2 jetties built, '83, 1504.

1883-'84. 216 snags and trees removed from 65 miles of channel, '84, 1657.

1884-'85. Work of cleaning river channel continued, '85, 1296.

1885-'86. 525 trees felled and removed; 70 logs and stumps cut; 611 logs and snags removed from river-bed, '86, 1160.

1886-'87. No operations, '87, 1277.

Projects.

By Capt. King, 1877, for formation of channel 80 feet wide and with a low-water depth of 4 feet, from Macon to mouth, by removal of sand and gravel bars, rock-reefs, snags, trees, and similar obstructions. Estimated cost, \$56,240, '87, 91, 600; '82, 1859.

The estimated cost was increased in 1882-'85 and '86 to \$112,480, '82, 1859; '85, 1297; '86, 1160; '87, 1276.

OCONEE RIVER, GA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 382.)

Appropriations.

1878-'79	\$11,500
1880	1,500, '80, 1704.
1881	2,500, '81, 1877.
1882	5,000, '82, 1861.
1884	3,000, '84, 1659.
1886	9,000, '86, 1162.

Total	32,500
1888	12,500, act of August 11, 1888.

Commerce.

Amount of traffic on the river, '83, 1504.

Contracts.

1887. M. A. Sweeney & Brothers, for steam snag-boat construction, at \$8,000, '87, 1275.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 190; '81, 257; '82, 251; '83, 258; '84, 258; '85, 200, 207; '86, 198; '87, 166.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1878-'85. Reports, '80, 1703; '81, 1876; '82, 1860; '83, 1505; '84, 1658.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1297, 1329, 1331; '86, 1161; '87, 1275.

ASSISTANTS.

B. W. Fobel. Reports, '80, 1703.

C. A. Locke. Reports, '84, 1658; '85, 1330, 1332.

Operations.

1879-'80. 813 snags, stumps, and trees removed from river between Dublin and mouth, '80, 1703.

1880-'81. 236 logs, snags, and trees, and quantities of drift removed, '81, 1877.

1881-'82. 30 cubic yards of rock excavated and 489 logs, snags, and trees removed, '82, 1860.

OCONEE RIVER, GA.—Continued.**Operations—Continued.**

1882-'83. 199 snags, 410 overhanging trees removed, and 245 cubic yards log and brush jetty put in, '83, 1505.

1883-'84. 352 cubic yards loose rock removed from channel; 340 cubic yards rock placed in dams and slope walls; 95 snags and trees removed, '84, 1658.

1884-'85. Channel cut through rock-reefs at Chaney's Shoal; snags and obstructions removed, '85, 1297.

1885-'86. No operations, '86, 1161.

1886-'87. 129 logs, snags, and trees removed, '87, 1275.

Projects.

By Maj. King, 1878, for both the prevention and formation of cut-offs, removal of snags, logs, and cutting through rock-reefs where necessary, so as to secure a 3-foot low-water navigation from mouth of river to Milledgeville, '78, 105, 768.

From 1878-'86, inclusive, \$36,500 was appropriated, when it was estimated that \$17,500 would be required to complete the project, '86, 1162.

Plans.

By Capt. Hoxie, 1885, for improvement of Oconee River between Skull Shoals and the Georgia Railroad Bridge, so as to give a channel 20 inches in depth and having a least width of 40 or 50 feet, by removal of rock obstructions, overhanging trees, and snags. Estimated cost, \$1,500, '85, 1332.

Surveys.

Of Upper Oconee, from Skull Shoals to the Georgia Railroad Bridge, ordered by act of July 5, 1884. Made, 1884, under direction of Capt. Hoxie, '85, 1329.

OCONTO HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 383.)

Appropriations.

1881.....	\$10,000, '81, 2062.
1882.....	15,000, '82, 2128.
1884.....	15,000, '84, 1841.
1886.....	8,000, '86, 1655.

Total	48,000
1888.....	20,000, act of August 11, 1888.

Commerce.

Commerce to be influenced by improvement, '90, 1975, 1976.

Lumber exportation, '80, 1974.

Contracts.

1882. Green Bay Dredge and Pile Driver Company, for slab-pier construction, '83, 1643.

1884. Schwarz & Berner, for pier extension, '85, 1982.

1887. Leathern & Smith, for poles, at 9½ cents per linear foot, '87, 2008. S. D. Kimbark, for iron, at 3¼ cents per pound, '87, 2008. Gregoire Denis, for stone, at \$4.24 per cord, '87, 2009. Leathern & Smith, for pine timber, at \$15.43 per M, B. M., '87, 2009.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 210; '81, 274, 2062, 2069; '82, 269; '83, 278; '84, 277; '85, 300; '86, 294; '87, 260.

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1879-'81. Report, '80, 1973.

Lieut. Col. H. M. Robert, 1881-'83. Reports, '81, 2061, 2064; '82, 2128; '83, 1644.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1642.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1840; '85, 1982.

Capt. C. E. L. B. Davis, 1886-'— . Reports, '86, 1653; '87, 2006.

ASSISTANTS.

W. H. Harding. Report, '80, 1975.

L. Y. Schermerhorn. Report, '83, 1647.

T. E. Hutchings. Report, '85, 1983.

Operations.

1882-'83. 300 linear feet of slab-pier built, '83, 1643.

1883-'84. North pier extended 1,100 feet and south pier 1,600 feet; 54,780 cubic yards material dredged from the channel, '84, 1840.

OCONTO HARBOR, WIS.—Continued.**Operations—Continued.**

1884-'85. 1,000 linear feet of pile protection completed and pier extension commenced; 56,671 cubic yards material dredged from channel, '85, 1892.

1885-'86. Protection piling completed; south pier completed by construction of 301 linear feet of close pile-pier; north pier extended 503 linear feet; 30,529 cubic yards material dredged; minor repairs to south pier, '86, 1893, 1894.

1886-'87. 66,661 cubic yards material dredged from channel between piers; repairs to south pier, '87, 2007.

History of past operations, '87, 2006.

Physical Characteristics.

Condition of river, 1879, '80, 1875.

Private and Corporate Work.

Work of improvement by the city of Oconto previous to 1880, '81, 2007.

Projects.

By Lieut. Col. Robert, 1881, for extension of slab-piers to 10-foot curve by construction of 4,000 linear feet of slab-pier and 500 linear feet of crib-pier; dredging a channel from the entrance to Oconto having a width of 100 feet and a depth 8 feet with 10 feet at entrance. Estimated cost, \$125,000, '81, 2007. Revised in 1883, after a resurvey of locality, to \$150,000, '83, 1846; '87, 2007.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Houston, '80, 187.

Of Oconto River, 1883, between mouth and city of Oconto; also of Green Bay in vicinity of mouth, '83, 1843.

MAPS.

'84, 1840.

OGDENSBURGH HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 384.)

Appropriations.

1882-'79	\$110,005.56
1882	10,000.00, '82, 2462.
1884	15,000.00, '84, 2153.
1886	10,000.00, '86, 1897.

Total 145,005.56

1888 15,000.00, act of August 11, 1888.

Appropriations prior to 1882, '82, 2461.

Contracts.

1882. F. Lee, for dredging, at 22 cents per cubic yard, '83, 1955.

Encroachments.

Deposit of saw-mill refuse in Oswegatchie River by mill owners, '85, 2294.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 233; '81, 319; '82, 313; '83, 323; '84, 327; '85, 353; '86, 346; '87, 312.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1875-'83. Reports, '80, 2218, 2219; '81, 2451; '82, 2461.

Lieut. Col. Robert, 1883-'85. Reports, '83, 1954; '84, 2153.

Maj. M. B. Adams, 1885-'— . Reports, '85, 2293; '86, 1895; '87, 2393.

ASSISTANTS.

F. T. Hampton. Report, '80, 2220.

M. Kingsley. Report, '80, 2222.

W. P. Judson. Report, '80, 2224.

Legal Proceedings.

Judgment for \$500 damages obtained by city of Ogdensburgh against mill owners on Oswegatchie River for obstruction of same by refuse matter, '85, 2294.

Operations.

1882-'83. 9,648 cubic yards material dredged from the channel, '83, 1954.

1883-'84. 25,697 cubic yards material dredged from the channel, completing the 1882 contract, '84, 2153.

1884-'85. 48,194 cubic yards material removed from channel, '85, 2295.

1885-'86. 14,998 cubic yards material dredged from channel, '86, 1897.

1886-'87. Dredging in progress along the city front, '87, 2394.

OGDENSBURGH HARBOR, N. Y.—Continued.**Projects.**

The project for the improvement of this harbor was adopted in 1867-'68, and proposed the deepening, by dredging, of the Oswegatchie River below the bridge, and also the St. Lawrence River along the city front to a depth of 12 feet, and the construction of two dikes, if found necessary, to direct the river currents, '68, 257, 270.

From 1852 to 1861, inclusive, \$110,005.56 was appropriated, '82, 2461.

In 1882 the project was modified so as to provide for a depth of 15 feet in the Oswegatchie and St. Lawrence channels and 16 feet depth on the outer bar. Estimated cost, \$76,000, '82, 2461; '85, 2294. Increased in 1885 to \$108,000, '85, 2295; '87, 2394.

Surveys.

Resurvey ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. McFarland, '80, 2219.

MAPS.

'80, 2218; '81, 2452; '87, 2394.

OHIO RIVER, except the Falls and the Louisville and Portland Canal—IMPROVEMENT OF.

(See also INDIANA CHUTE, ICE-HARBORS ON OHIO RIVER, GREAT MIAMI RIVER, AND LICKING RIVER.)

(Continued from Vol. I, p. 386.)

Appropriations.

1835-'79.....	\$2,408,479.25
1880.....	250,000.00, '80, 1752.
1881.....	350,000.00, '81, 1922.
1882.....	450,000.00, '82, 1929.
1884.....	600,000.00, '84, 1689.
1886.....	375,000.00, '86, 1536.

Total.....	4,433,479.25
1888 { Improvement of Ohio River.....	380,000.00, act of August 11, 1888.
{ Ohio River below Pittsburgh, to defray	
expenses of Board of Engineers.....	10,000.00, act of August 11, 1888.

NOTE.—The appropriation for 1880 provides for the application of \$10,000 to the improvement of Indiana Chute; the appropriation of 1881 for \$50,000.

The appropriation of 1884 provides for \$7,500 for ice-harbor at the mouth of Great Kanawha River, and \$50,000 for construction of levees at Jeffersonville.

The appropriation of 1886 provides for \$18,750 for embankment at mouth of Great Miami River, \$37,500 for ice-piers at various localities, \$18,750 for the removal of obstructions at mouth of Licking River, and \$11,250 for completion of ice-harbor near Cincinnati.

Commerce.

Vessel statistics, '80, 1749; '81, 1920; '82, 1925; '83, 1531; '84, 1687; '85, 1802; '86, 1539; '87, 1794.

River freight rates, '80, 1749; '81, 1920; '82, 1925; '83, 1532; '84, 1686; '85, 1801; '86, 1539; '87, 1793.

Losses by collisions with bridges, '82, 1925.

Vessels passing the Falls, '83, 1529; '84, 1683; '86, 1539; '87, 1794.

Vessels passing Davis Island Dam, '87, 1799.

Diagram of largest coal tow, '84, 1685.

Duration of ice season, '87, 1795.

Contracts.

1879. E. G. Penn, for dike construction at Portland Bar, '80, 1738. C. M. Cole, for dike construction at Grand Chain, '80, 1740.

1880. Hill Wrecking Company, for removal of wreck at head of Grand Chain, '81, 1911.

1881. Covington Dock Company, for construction of 4 dump-scows, '81, 1912. H. A. Ramsey & Co., for iron-work of Davis Island Dam, '81, 1912. N. W. Tucker, for dam and dike construction at Brown Island, '81, 1912. Clendinen & Graham, for dike at Twelve-Pole Bar, '81, 1912. J. Clark, for dike at Puppy Creek Bar, '81, 1913.

OHIO RIVER—Continued.

Contracts—Continued.

1882. Pittsburgh Bridge Company, for iron-work for Davis Island Dam, '82, 1910. W. Cook, W. H. Sherwood & Co., Sewickley Lumber Company, Walter & Darrah, H. B. Nease, for timber, '82, 1911, 1912. F. O. Norton, for cement, '82, 1912. Allen & Blaisdell, for iron dredge hull, '83, 1512.
1883. Miller Chain Company, for chain, '83, 1512. W. H. Ewing, for lock-gate timber, '83, 1512. Queen City Bridge and Steam Forging Company, for iron-work, '83, 1512. J. W. Cook, for two barges, '83, 1513.
1884. J. B. Thompson, for towing dredges, '85, 1776. Scaife Foundry and Machine Company, W. Kirup & Son, Cincinnati Iron Company, Queen City Bridge and Steam Forging Company, and Oliver Brothers and Phillips, for iron-work for Davis Island Dam, '85, 1777, 1778. F. O. Norton, for cement, '84, 1778. J. B. Holbrook, for dike construction at Merriman Bar, '85, 1778. Porter, Tucker & Mahon, for dam construction at Black's and Brown's islands, '85, 1779. I. V. Hoag, for dam at Wheeling Island, '85, 1779. J. B. Holbrook, for dam at Captina Island and Fish Creek Island, '85, 1780. J. F. King, for dike at Three Brothers, '85, 1781. J. C. Graham, for dike at Sand Creek, '85, 1781. J. J. Shipmans, for dike at Eight-mile Bar, '85, 1782. Kirk & Co., for dike at Rising Sun, '85, 1782. J. H. Morris, for dike at Flint Island, '85, 1783. I. V. Hoag, for dike at Grand Chain, '85, 1783.
1885. Allen & Blaisdell, for repairs to snag-boat Woodruff, '85, 1784. J. Coyne, for construction of levee at Jeffersonville, '85, 1793. Stubbs & Lackey, for dike at Merriman Bar, '86, 1529. Queen City Bridge and Steam Forging Company, for maneuvering boat at Davis Island Dam, '86, 1536.
1886. J. G. Fritsch, for repairs to snag-boat, '86, 1536. N. W. Tucker, for riprap stone, '86, 1536. Fulton Tow-Boat Company, for towing, '87, 1789. J. S. Routh, for crib-work at Davis Island Dam, '87, 1790. F. Gwinner, for filling and paving, '87, 1790. Crescent City Wrecking Company, for rock removed at Grand Chain, '87, 1790.
1887. J. G. Fritsch, for lock-gate engines, '87, 1790. S. D. Davis, for towing United States dredges, '87, 1791.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 191; '81, 260, 263, 1927; '82, 254; '83, 260; '84, 260, 263, 1689; '85, 280; '86, 271, 272; '87, 236, 238.

BOARD OF ENGINEERS.

Convened November, 1890, to examine and report upon plans submitted by Herman Haupt for the improvement of the Ohio River. Report, '81, 1928-1935.

Plans not considered practicable by the Board, '81, 1934.

Report reviewed by Herman Haupt, '81, 1936-1943. (Cols. Tower and Newton, Lieut. Col. Abbot, and Maj. Merrill.)

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1870—. Reports, '80, 1737; '81, 1911, 1922; '82, 1909; '83, 1511; '84, 1677, 1689, 1715; '85, 1776, 1802; '86, 1538; '87, 1781.

Operation and care of Davis Island Dam, '85, 1802; '86, 1540; '87, 1796.

ASSISTANTS.

Capt. F. A. Mahan. Reports, '83, 1513; '84, 1678.

E. J. Carpenter. Report, '83, 1524.

P. J. Schopp. Reports, '83, 1528; '84, 1681; '85, 1795.

D. A. Clark. Report, '84, 1691.

W. Martin. Reports, '85, 1784; '86, 1540; '87, 1797.

Operations.

1879-'80. Progress on Davis Island Dam, '80, 1737. Dike and dam construction and repair of Portland Bar, French Island, Evansville, Henderson Island, and Grand Chain, '80, 1737-1741. Rock removed by hired labor, '80, 1741, 1742. Operations of snag-boat Woodruff, '80, 1742. 75,693 cubic yards gravel and clay and 5,487 cubic yards of rock removed by United States dredges, '80, 1743-1746. Cost of dredging, '80, 1746.

1880-'81. Progress on Davis Island Dam, '81, 1913. Dike construction at Portland Bar and Grand Chain, '81, 1914. 62,740 cubic yards gravel and 7,955 cubic yards rock removed by United States dredges, '81, 1914-1917. Operations of snag-boat Woodruff, '81, 1917. Rock removed by contract at Little Chain, '81, 1907. Cost of dredging, '81, 1916.

1881-'82. Progress on Davis Island Dam, '82, 1912. Dike and dam construction at Brown Island, Twelve Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, '82, 1914. 37,294 cubic yards gravel and 10,378 cubic yards loose rock removed by United States dredges, '82, 1916, 1919. Operations of snag-boat Woodruff, '82, 1920. Rock removal, by contract, at Grand Chain, '82, 1921. Cost of dredging, '82, 1919.

OHIO RIVER—Continued.**Operations—Continued.**

- 1882-'83. Progress at Davis Island Dam, '83, 1513. Dike and dam construction at Brown's Island, Twelve Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, '83, 1518, 1520. 110,775 cubic yards gravel, 4 wrecks, and 60 tons of rock removed by United States dredges, '83, 1520. Completion of new iron-hull dredge, '83, 1524. Operations of snag-boat Woodruff, '83, 1526. Rock removal at Mustapha Island, '83, 1526. Operations at Indiana Chute, '83, 1527, 1528.
- 1883-'84. Progress at Davis Island Dam, '83, 1678, 1679. Dike and dam construction at The Trap, Brown's Island, Twelve Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, '83, 1680. No operations of dredges or snag-boat, '83, 1681. Rock removal at mouth of Licking River, '83, 1681. Progress at Falls of the Ohio, '83, 1681.
- 1884-'85. Progress at Davis Island Dam, '85, 1784. Dike and dam construction at Merriman Bar, Black's Island, Brown's Island, Captina Island, Fish Creek Island, Twin Brothers, Sand Creek, Eight-mile Bar, Rising Sun, and Grand Chain, '85, 1786, 1787. 20,611 cubic yards gravel, 23,756 cubic yards rock, 5 wrecks, and 7 snags removed by United States dredges, '85, 1788-1791. Cost of dredging, '85, 1791, 1792. Operations of snag-boats, '85, 1793. 5,547 tons of rock removed by contract, '85, 1794, 1795. 3,763 cubic yards rock removed and guiding dikes built, by hired labor, at Indiana Chute, '85, 1795. Jeffersonville Levee commenced, '85, 1798.
- 1885-'86. Davis Island Dam opened to navigation October 7, 1885, '86, 1528. Operation of dam, '86, 1540. Dike and dam construction at Merriman Bar, Black's Island, Brown's Island, Wheeling Island, Captina Island, Fish Creek Island, Three Brothers, Sand Creek, Eight-mile Bar, Rising Sun, and Grand Chain, '86, 1529-1533. No operations by United States dredges, '86, 1533. Operations of snag-boats, '86, 1533. Progress on Jeffersonville Levee, '86, 1534.
- 1886-'87. Operation and care of Davis Island Dam, '87, 1792, 1796. Dike and dam construction at Merriman Bar, Black's Island, Brown's Island, Wheeling Island, Captina Island, Fish Creek Island, Three Brothers, Sand Creek Bar, Eight-mile Bar, Rising Sun Bar, and Grand Chain, '87, 1182-1782. 897 tons of rock removed from Grand Chain, '87, 1785. Jeffersonville Levee completed, '87, 1786. 46,855 cubic yards gravel and 34 tons of rock removed by United States dredges, '87, 1787. Cost of dredging, '87, 1787, 1788. Operations of snag-boat, '87, 1788.

Projects.

- The early projects for the improvement of the Ohio River were directed towards obtaining a minimum low water of 2½ feet, '66, iii, 25, iv, 244, 246, 259, 261, 271. As the commercial requirements of the river increased the necessity for a greater low-water depth became apparent, '73, 499.
- In 1874 Maj. Merrill proposed the radical improvement of the river above the Falls so as to secure a minimum depth of 6 feet by means of movable dams, '74, i, 64, 406-410. (See also Index to Reports of the Chief of Engineers, Vol. I, p. 390.)
- The general method of improvement has been to remove snags and rocks, to close up duplicate channels by low dams, to hold up and guide the water by dikes where the river had an excessive width, and to remove, by dredging, hard bars and projecting points, '84, 261.
- The radical improvement of the river so as to secure a low-water depth of 6 feet was commenced in 1878 by the construction of the Davis Island Dam, '79, 143, 1299, which was opened to navigation in 1885, '86, 1528. The cost of this work was about \$910,000, '86, 271.
- The total amount appropriated from 1827 to 1886, inclusive, was \$4,443,479.25, including \$75,000 from the appropriations of 1880 and 1881 for improving Indiana Chute.

Physical Characteristics.

- Slope, '81, 1929.
 Discharge, '81, 1929.
 Floods of, '84, 1687.
 Duration of ice season, '87, 1795.

Plans.

- Maj. Merrill did not consider that the suggested changing of the channel at Elizabethport, Ill., to the north side of Hurricane Island should be entertained, '81, 1922-1926.
- By Herman Haupt, for the improvement of the Ohio River, by a series of dams at the heads of the ripples and the contraction of the channel along the ripple to a width of 300 feet; where necessary the 300-foot channel to be further contracted by movable wickets, '81, 1937, 1938.
- Plan not considered admissible by the Board of Engineers of 1881, '81, 1934.
- By Col. Merrill, 1884, for a levee to prevent overflow of floods at Jeffersonville, Ind. Estimated cost, \$50,000, '84, 1689-1692.

OHIO RIVER—Continued.**Surveys.**

Survey from Hurricane Island to Elizabethport ordered by act of June 14, 1880.
Made under direction of Maj. Merrill, 1881, '81, 1922.

MAPS.

Of Davis Island Dam, '83, 1518.
Of Indiana Chute, '85, 1795.

OHIO RIVER, Falls of. (INCLUDING THE LOUISVILLE AND PORTLAND CANAL
AND INDIANA CHUTE.)

(Continued from Vol. I, p. 391.)

Appropriations.

1852-'79	\$1,468,200
1880	* 10,000, '81, 1899.
1881	50,000, '81, 1902.
1882	35,000, '82, 1878; '83, 1527.
1884	300,000, '84, 1699.
1886	150,000, '86, 276.
Total	2,013,200
1888 { Falls of Ohio River, including Louisville and Portland Canal.....	150,000.
{ Indiana Chute Fall.....	15,000, act of August 11, 1888.

Commerce.

Tolls abolished after July 1, 1880, '80, 191.
1879-'80. Commerce passing the canal, '80, 1725, 1731.
1880-'81. Commerce passing the canal, '81, 1900, 1903, 1908.
1881-'82. Commerce passing the canal, '82, 1907.
1882-'83. Commerce passing the canal, '83, 1533.
1883-'84. Commerce passing the canal, '84, 1698.
1884-'85. Commerce passing the canal, '85, 1808.
1885-'86. Commerce passing the canal, '86, 1580.
1886-'87. Commerce passing the canal, '87, 1850.
Statement of commerce passing the Falls by canal and by river from 1880 to 1887,
'87, 1852.

Dry-dock facilities on the Ohio River, '87, 1876-1901.

Contracts.

1884. Salem Stone and Lime Company, for lock-sill stone, '84, 1693. Burnet & Co.,
for construction of iron dredge hull, '85, 1803.
1885. I. Malloy and G. W. Lewis, for earth and rock excavation, '85, 1811, 1812;
'86, 1569. Gleason & Gosnell, for rock excavation, at 85 cents per cubic yard,
'86, 1571.
1886. M. A. Sweeney & Brothers, for tow-boat, '86, 1577.
1887. Gleason & Gosnell, for earth excavation, at 17½ cents per cubic yard, and
rock removal, at \$1.05 per cubic yard, '87, 1840. Salem Stone and Lime Com-
pany for masonry, at \$10.43 per cubic yard, '87, 1840. M. A. Sweeney &
Brothers, for tow boat machinery, '87, 1847.

Encroachments.

Relating to discharge of sewage of city of Louisville into the canal, '87, 1852-1863.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 191, 1728; '81, 258; '82, 252, 253; '83, 261, 263; '84, 261, 262; '85,
251, 282; '86, 276, 277; '87, 244, 245, 246, 249, 1854.

ENGINEERS IN CHARGE.

Lieut. Col. G. Weitzel, 1867-'82. Reports, '80, 1723, 1724, 1727, 1729; '81, 1899,
1904; '82, 1877, 1880, 1903.

Maj. F. U. Farquhar, 1882. '83, '260.

Lieut. Col. W. E. Merrill, 1882-'86. Reports, '83, 1527, 1533, 1539; '84, 1681,
1692, 1699; '85, 1803, 1811.

Maj. A. Stickney, 1886-'—. Reports, '86, 1569, 1572, 1574; '87, 1838, 1842, 1843,
1855, 1896.

* Allotted from Ohio River.

OHIO RIVER—Continued.**Engineers—Continued.****ASSISTANTS.**

- P. J. Schopp. Reports, '81, 1902, 1906; '82, 1879, 1903; '83, 1537; '84, 1694; '85, 1805, 1813.
 T. H. Taylor. Reports, '86, 1578; '87, 1847.
 G. W. Shaw. Reports, '86, 1571; '87, 1840.
 C. L. Cornwell. Reports, '86, 1573; '87, 1862.
 J. P. Claybrook. Report, '87, 1842.

Legislation.

History of canal, '82, 1881-1883.

Laws relating to the Louisville and Portland Canal, '83, 1540; '87, 1857.

Act of Congress making canal free from tolls after July 1, 1880, '80, 1724.

Operations.

- 1879-'80. Progress on improvement of Indiana Chute, '80, 1723. Operation and maintenance of canal, '80, 1724, 1729. 60,934 cubic yards material excavated from canal, '80, 1727.
 1880-'81. Progress on Indiana Chute, '81, 1599, 1902. Operation and maintenance of canal, '81, 1904. 61,598 cubic yards material dredged from canal, '81, 1909.
 1881-'82. Progress on Indiana Chute, '82, 1877. Operation and maintenance of canal, '82, 1903, 1908. 82,198 cubic yards material dredged from canal, '82, 1908.
 1882-'83. Progress on Indiana Chute, '83, 1527. Operation and maintenance of canal; 111,916 cubic yards material dredged from canal, '83, 1533, 1537.
 1883-'84. Progress on Indiana Chute, '84, 1681. Operation and maintenance of canal; 100,760 cubic yards material dredged from canal, '84, 1692, 1694.
 1884-'85. Operation and maintenance of canal, '85, 1803. 79,975 cubic yards material dredged from canal; rebuilding middle miter-sill; pipes for removal of debris placed in new locks; new dredge in process of construction with repairs to old dredge, '85, 1804, 1805. 817 cubic yards earth and 2,363 cubic yards rock removed in enlargement of canal entrance, '85, 1811, 1813.
 1885-'86. On canal enlargement 121,402 cubic yards earth, 16,986 cubic yards solid rock, 4,484 cubic yards loose rock, and 15,226 cubic yards dry wall removed, '86, 1571. 451 cubic yards rock removed from Indiana Chute, and repairs made to cross-dam, '86, 1572, 1573. Operation and maintenance of canal, '86, 1574, 1578. 102,312 cubic yards dredged from canal; completion of dredge hull; repair of locks, '86, 1574, 1578.
 1886-'87. On canal enlargement 29,143 cubic yards earth, 40,666 cubic yards solid rock, 8,963 cubic yards loose rock, and 5,785 cubic yards dry wall removed; 630 cubic yards masonry laid, '87, 1838, 1841. On enlargement of canal basin, 66,246 cubic yards earth and 341 cubic yards rock removed, '87, 1838, 1842. Repairs to dams at Indiana Chute, '87, 1842. Operation and maintenance of canal, '87, 1842, 1848. 106,720 cubic yards dredged from canal, '87, 1849.

Physical Characteristics.

Description of Falls, '82, 1881.

Analysis of water in Louisville and Portland Canal, '87, 1863. (See also ENCROACHMENTS.)

Plans.

By Maj. Weitzel, 1882, for conversion of 1,300 feet additional dam on crest of the Falls into movable dams; enlargement at head of canal; construction of an independent coal canal; for widening present canal; for gates in canal branch above new locks; for new lock parallel to present locks; for new dry-dock; for enlarging basin at head of locks. Estimated cost, \$5,915,108, '82, 1893-1902. Reasons for modifications, '83, 1539.

By Maj. Stickney, 1887, for the enlargement of the dry-dock at Louisville, at an estimated cost of \$310,416, '87, 1896-1900.

Private and Corporate Work.

See Index to Reports of Chief of Engineers, Vol. I, p. 394; also, '82, 1881; '87, 1852. History of the canal, '82, 1881-1893; '87, 1852.

Projects.

A company chartered by the State of Kentucky to build and operate a canal with locks at Louisville began work in 1828, and opened the canal to traffic in 1830, at a cost of \$1,019,277, '66, iv, 264; '82, 1882.

By acts of Congress of May 13, 1826, and March 2, 1829, the United States became the owner of 2,335 shares of the stock of the company at a cost of \$233,500.

Between 1868 and 1875, inclusive, \$1,463,200 was appropriated for the improvement of the Falls of the Ohio and applied to the enlargement of the canal and the improvement of Indiana Chute.

In 1874 the Government assumed control of the canal and on July 1, 1880, in accordance with the act of May 18, 1880, the canal was made free from all tolls. The summarized cost of the works stated as about \$4,800,000, '82, 1882-1893.

OHIO RIVER—Continued.**Projects—Continued.**

The project was modified in 1883 to provide for the enlargement of the existing canal by moving its northern wall to the north limit of the canal property; the removing of the present guiding-dike and cross-dam; the construction of a dam along the easterly line of the Louisville Cement Company's property, and thence to the southern end of the opening for Middle Chute. Estimated cost, \$1,335,363, '83, 1539; '85, 1812.

Indiana Chute: the object of this work was to render the channel over the Falls navigable for coal-boats at all stages when they could reach Louisville, by widening the crooked and narrow channel by rock removal and facilitating navigation by building guiding-dikes. The amount appropriated for the work to June 30, 1887, was \$125,000. The estimated cost of completion, \$130,000, '87, 1483.

Surveys.

Showing proposed changes at head of canal, '83, 1539; '85, 1812.
Indiana Chute, '86, 1572.

OHIO RIVER near city of Evansville—EXAMINATION OF.

Ordered by act of August 5, 1886, to determine a means for preventing a change of the river channel in front of the city, '87, 244.

OHIO RIVER at Parkersburgh—EXAMINATION FOR ICE-BREAKERS AT.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '80, 195; '81, 263.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '81, 1954.

Plans.

By Maj. Merrill, 1880, for construction of two ice-breakers consisting of cribs filled with stone. Estimated cost, \$6,000, '80, 1795, 1796.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Merrill, '81, 1954.

OHIO RIVER at Rochester and Freedom, Pa.—SURVEY FOR ICE-HARBOR AT.**Commerce.**

Necessity for ice-breakers, '85, 1710, 1712, 1714.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 263.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1710, 1711.

ASSISTANT.

E. J. Carpenter. Report, '85, 1713.

Plans.

By Lieut. Col. Merrill, 1893, for an ice-breaker at the mouth of Elk Horn Creek, at an estimated cost of \$5,500, '85, 1712, 1713.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Lieut. Col. Merrill, '85, 1710,

OLCOTT HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 394.)

Appropriations.

1857-'79	\$115,000
1881.....	3,000, '81, 2434.
1886.....	10,000, '86, 1886.
1888.....	5,000, act of August 11, 1888.
Appropriations prior to 1881, '81, 2434.	

Commerce.

Commerce trifling and requirements limited, '86, 1886.

Contracts.

1887. M. S. Vosburger, for timber, at \$24.90 per M feet, and stone, at \$1.22 per cubic yard, '87, 2368.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 230; '81, 316; '82, 310; '83, 318; '84, 322; '85, 347; '86, 341; '87, 307.

ENGINEERS IN CHARGE.

Lient. Col. W. McFarland, 1875-'83. Reports, '80, 2205; '81, 2433; '82, 2442.

Lient. Col. H. M. Robert, 1883-'85. Reports, '83, 1940; '84, 2135.

Capt. E. Maguire, 1885-'86. Reports, '85, 2269; '86, 1885.

Capt. C. F. Palfrey, 1886. '87, 2368.

Capt. F. A. Mahan, 1886-'—. Report, '87, 2368.

Operations.

1881-'82. 305 linear feet of west pier rebuilt from water-line and 90 linear feet of shore-arm constructed, '82, 2442.

1892-'87. No operations, '83, 1940; '84, 2135; '85, 2269; '86, 1885; '87, 2368.

Projects.

The original project was adopted in 1866 and proposed to connect deep water in Lake Ontario with deep water in Eighteen-mile Creek by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the formation of a dredged channel between the piers. Estimated cost, \$117,927, '66, iii, 15; iv, 158, 159; '74, i, 239; '86, ii, 578; '81, 2434.

The project was modified in 1872 to provide for the removal of rock in the channel between the piers, '72, 46, 248; '74, i, 239. Also in 1881 to provide for additional pier extension, at an estimated cost of \$30,000 in excess of the original estimate, '81, 2434.

Surveys.**MAPS.**

'81, 2434.

OLD RIVER BED, CUYAHOGA RIVER. (See CUYAHOGA RIVER HARBOR.)**OLD TOWN CREEK, MISS.—IMPROVEMENT OF.****Appropriations.**

1882..... \$3,000, '83, 1000.

Commerce.

Prospective benefits to commerce consequent upon opening water-way, '83, 1000.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 213; '82, 186; '83, 192; '84, 200; '85, 210; '86, 208; '87, 174.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1881-'—. Reports, '82, 1326; '83, 999; '84, 1191; '85, 1355; '86, 1200; '87, 1327.

ASSISTANT.

H. Harding. Report, '82, 1326.

Operations.

1883-'84. 13,016 trees cut and removed from banks and 853 logs and stumps removed from bed of stream, '84, 1191.

1884-'87. No operations for lack of funds, '85, 1355; '86, 1201; '87, 1328.

OLD TOWN CREEK, MISS.—Continued.**Projects.**

By Maj. Daurell, 1882, for improvement of Old Town Creek for high-water navigation from its mouth up to City Point, a distance of about 30 miles, by the removal of overhanging and fallen trees, snags, and accumulated drift. Estimated cost, \$10,000, '82, 1326, 1327.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Maj. Benyard, '82, 1326.

OLYMPIA HARBOR, WASH.—SURVEY OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 369.

ENGINEERS IN CHARGE.

Capt. C. F. Powell. Report, '85, 2413.

Lieut. E. Burr. Report, '85, 2415.

ASSISTANT.

P. G. Eastwick. Report, '85, 2414.

Physical Characteristics.

Locality described, '85, 2414.

Plans.

By Lieut. Burr, 1885, for the formation of a channel by dredging, aided, by a jetty from Capitol Point 8 feet deep at low water. Estimated cost, \$147,950, '85, 2416.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Burr, '85, 2415.

OMAHA, NEBR. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**ONANCOCK HARBOR, VA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 397.)

Appropriations.

1879..... \$3,000

1880..... 5,000, '80, 646.

Commerce.

Advantages consequent upon improvement, '80, 647.

Contracts.

1879. D. Constantine, for dredging, at 17½ cents per cubic yard, '80, 646.

1880-'81. American Dredging Company, for dredging, at 20 cents per cubic yard, '81, 890.

Engineers.

CHIEF OF ENGINEERS.

R ports, '80, 105; '81, 141; '82, 137; '83, 140.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1879-'83. Reports, '80, 645; '81, 889; '82, 859; '83, 683.

Operations.

1879-'80. 9,727 cubic yards material dredged from the channel, '80, 646.

1880-'81. 20,297 cubic yards material dredged from the channel, '81, 890.

1881-'82. No operations, '82, 859.

Projects.

By Capt. C. B. Phillips, 1879, for dredging a channel through the bar at mouth of the harbor and near the wharves 300 feet wide and 8 feet in depth at mean low water, at an estimated cost of \$10,000, '79, 511, 716, 717, 718; '80, 645.

Surveys.

Resurvey, 1882, '82, 859.

ONTONAGON HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 397.)

Appropriations.

1867-'79	\$212,600
1880	15,000, '80, 1898.
1881	20,000, '81, 2034.
1882	20,000, '82, 2114.
1884	15,000, '84, 1826.
1886	13,000, '86, 1643.

Total	285,600
1868	12,500, act of August 11, 1888.

Commerce.

Requirements of general lake commerce and availability as a harbor of refuge justify completion of work, '80, 1898.

Contracts.

1880. McDougall & McLennan, for pier construction, '81, 2035.
 1881. J. Rich, for pier extension, '81, 2036.
 1882. J. Rich, for pier extension, '83, 1631.
 1884. J. H. Gillette, for pier extension, '85, 1669.
 1886. A. S. Bretherton, failure to enter into contract, '87, 1967. Contract awarded to W. T. Casgrain, '87, 1968.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 202; '81, 271; '82, 266; '83, 274; '84, 273; '85, 296; '86, 290; '87, 256.

ENGINEERS IN CHARGE.

- Lieut. Col. H. M. Robert, 1875-'83. Reports, '80, 1897; '81, 2033; '82, 2114.
 Capt. F. A. Hinman, 1883-'84. Report, '83, 1630.
 Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1825; '85, 1968.
 Capt. C. E. L. B. Davis, 1886-'—. Reports, '86, 1641; '87, 1967.

Operations.

- 1879-'80. 4 cribs placed in extension of west pier and superstructure built over 9 cribs, '80, 1897, 1898.
 1880-'81. 3 cribs placed in extension of the east pier and 5 in the west; 2 courses of superstructure placed over 4 cribs in the west pier and superstructure for 3 cribs furnished, '81, 2034.
 1881-'82. 4 crib superstructures placed in extension of west pier and 3 in east pier; also superstructure built over 4 cribs in west pier, '82, 2114.
 1882-'83. 2 cribs placed in extension of the east pier and 400 linear feet superstructure built over same; partial superstructure completed over 6 cribs in west pier, '83, 1630.
 1883-'84. East pier extended 250 feet and 200 linear feet of planked superstructure built; 20 snubbing posts placed in east and west piers, '84, 1826.
 1884-'85. West pier extended 100 feet and 950 linear feet of superstructure built, '85, 1964.
 1885-'86. East pier advanced 75 feet; 10,546 cubic yards material dredged from the channel, '86, 1642.
 1886-'87. 100 linear feet of crib-work of west pier leveled to receive superstructure; minor repairs to piers, '87, 1968.

Projects.

By Maj. Wheeler, 1867, for construction of 2 parallel piers of crib-work 250 feet apart, extending 2,160 feet from the mouth of Ontonagon River to the 18-foot curve in Lake Superior, with the dredging of the channel between the piers to a depth of 12 feet. Estimated cost, \$363,770, '67, 20, 63, 65; '86, 1641. Aggregate of appropriations from 1867 to 1886, inclusive, \$285,600, '86, 1642; '87, 1967. Probable increase of estimate due to the advance of the outer bar, '86, 1641; '87, 1967.

OOSTENAULA AND COOSAWATTEE RIVERS, GA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 399.)

Appropriations.

1874-'79	\$22,000
1880	2,000, '80, 1693.
1881	1,000, '81, 1874.
1882	1,000, '82, 1858.

Total	26,000
-------------	--------

OOSTENLAULA AND COOSAWATTEE RIVERS, GA.—Continued.**Encroachments.**

Further expenditures not recommended until the railroad bridge near Rome is provided with a suitable draw, '87, 1278.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 188; '81, 256; '82, 249; '83, 257; '84, 257; '85, 201; '86, 199; '87, 167.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1875-'85. Reports, '80, 1692; '81, 1873; '82, 1857; '83, 1503; '84, 1656.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1300; '86, 1185; '87, 1278.

Operations.

1879-'80. 472 cubic yards rock and bowlders and 313 cubic yards gravel excavated and 441 snags and overhanging trees removed; 807 cubic yards rock quarried and 1,513 cubic yards rock placed in dams, '80, 1692.

1880-'81. 3,042 cubic yards gravel, loose rock, and 111 cubic yards solid rock excavated; 133 cubic yards of stone quarried; 287 cubic yards stone placed in dams; 46 snags and trees removed, '81, 1874.

1881-'82. 131 cubic yards solid rock and 366 cubic yards loose rock and gravel excavated; 26 snags removed, '82, 1857.

1882-'87. No operations through completion of improvement, '86, 199; '87, 1278.

Projects.

By Capt. Overman, 1874, to secure a 3-foot depth of channel in the Oostenaula, and on the Coosawattee good navigation for boats drawing 2 feet during nine months of the year, the improvement to be accomplished by the removal of snags and trees, gravel, and rock bars. Estimated cost for Oostenaula, \$12,000, and for the Coosawattee, \$16,208.50, '74, i, 583; '75, i, 794; '80, 1693.

OREGON INLET, N. C.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 168; '82, 164.

ENGINEER IN CHARGE.

Capt. J. Mercur. Report, '82, 1127.

Plans.

In 1882 Capt. Mercur considered that the unstable character of the bar covering the inlet would render an attempted improvement futile without large cost, '82, 1128.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Capt. Mercur, '82, 1127.

OSAGE RIVER, MO. AND KANS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 400.)

Appropriations.

1871-'79	\$140,000
1880	30,000, '80, 1395.
1881	20,000, '81, 1589.
1886	10,000, '86, 1396.

Total	200,000
1888	5,000, act of August 11, 1888.
Statement of appropriations, '85, 1636; '86, 1396.	

Commerce.

Steam-boat traffic upon river, '81, 1593.

Lumber interests, '87, 1592.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 161; '81, 222; '82, 220; '83, 228; '84, 235; '85, 254, 259; '86, 246; '87, 214.

OSAGE RIVER, MO. AND KANS.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Col. J. H. Simpson, 1873-'80. Report, '80, 1359.

Maj. O. H. Ernst, 1880-'85. Reports, '80, 1391; '81, 1586; '82, 1656; '83, 1293; '84, 1529.

Maj. A. M. Miller, 1885-'—. Reports, '85, 1636, 1657; '86, 1306; '87, 1591, 1593.

ASSISTANTS.

W. S. Simpson. Reports, '81, 1589; '82, 1657.

S. E. M. Gregory. Report, '82, 1667.

K. Winston. Report, '83, 1294.

Operations.

1879-'80. Rock and snag removal at Reynold's Shoal and Devil's Elbow; dam strengthened, training-wall repaired and extended, and snags removed at Moore's Flats; dams and training-walls built at Haskin's and Burd's shoals, and breach at latter place repaired; channels dredged at Kirkman's, Pack's, and Clark's Island shoals, also dam built at first-named locality; training-wall extended and break in dam repaired at Shipley's Shoal, '80, 1392, 1394.

1880-'81. Training-walls extended at Shipley's and Burd's shoals; dredging and snag removal at Musie's, Saline, and Town shoals, and dredging at Lockett's Island Shoal; rock quarried and channel excavation begun at Moore's Flats; break in training-wall repaired and bar removed at Kirkman's Shoal; channel dredged at Rice's Shoal; cross-dam and training-wall built, excavation of channel begun, and snags removed at Berry's Shoal, '81, 1586, 1587.

1881-'82. Straightening of chute completed, dam and training-wall extended, and dredging done at Moore's Flats; training-wall extended, raised, and repaired, and dredging done at Berry's Shoal; dredging done at Schieless, Clark's Island, Haskin's and Kirkman's shoals; 1,063 snags removed from channel between Grand River and mouth of Osage, '82, 1656.

1882-'83. 310 snags removed from river between Big Gravois and mouth of Osage, '83, 1293.

1883-'86. No operations for lack of funds, '84, 1529; '85, 1636; '86, 1395.

1886-'87. 370 snags and 878 trees removed, '87, 1592.

Physical Characteristics.

Gauge records at Tuscumbia and Warsaw for 1881, '81, 1593, 1594; '82, 1661; '83, 1295; '84, 1530.

Plans.

In 1884 Maj. Ernst did not consider that the river was worthy of improvement by movable locks and dams, '85, 1658.

In 1886 Maj. Miller expressed the same conclusion, '87, 1594.

Projects.

The original project adopted in 1871 proposed contracting the width of the river at shoals by means of cross-dams and training-walls, dredging the channel by means of teams and scrapers, and removal of rocks and snags from channel and trees from banks, the object being to obtain a 2-foot low-water navigation. The estimated cost of this improvement was \$230,000, '71, 238; '86, 1395.

Surveys.

Of river, 1881, above Tuscumbia, '81, 1588.

Of Osage River from Tuscumbia to mouth of Rainey Creek, 1881, '82, 1662.

Examination of river from mouth to Osceola, with view to formation of slackwater navigation by movable locks and dams. Made, 1884, under direction of Maj. Ernst, '85, 1657; and also in 1886 under direction of Maj. Miller, '87, 1593.

MAPS.

'80, 1394.

OSWEGO, N. Y.—CONSTRUCTION OF BREAKWATER AT.

(Continued from Vol. I, p. 401.)

Appropriations.

1876-'79	\$1,264,362.87
1880	90,000.00, '80, 2217.
1881	50,000.00, '81, 2449.
1882	80,000.00, '82, 2456.
1884	80,000.00, '84, 2145.
1886	71,250.00, '86, 1893.

Total 1,635,612.87
 1888 100,000.00, act of August 11, 1888.

OSWEGO, N. Y.—Continued.

Contracts.

1881. J. H. Case, for timber and stone filling, at \$1.10 per cubic yard and dredging, at 75 cents per cubic yard, '81, 2451. F. B. Gay, for iron, '81, 2451. G. Kellogg, for removal of rock, at \$7 per cubic yard, and other material, at 70 cents per cubic yard, respectively, '81, 2451. G. Kellogg, for timber and stone filling, at \$1.35 per cubic yard, and dredging, at \$1.25 per cubic yard, '81, 2451. F. Wilson, for iron, '81, 2451.
1882. F. Wilson, for iron, '83, 1948.
1883. F. Lee, for dredging, at 30 cents per cubic yard, '84, 2143.
1884. Post & Henderson, for timber, '84, 2146.

Encroachments.

Construction of coal-trestle by Delaware, Lackawanna and Western Railroad Company in harbor formed by west breakwater, '83, 1949.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 232; '81, 319; '82, 313; '83, 321; '84, 325; '85, 350; '86, 345; '87, 310.

BOARD OF ENGINEERS.

Convened at New York February 15, 1837, to report upon removal of east breakwater in Oswego Harbor. Report, '87, 2390. (Cols. Casey and Abbot and Lieut. Col. Houston.)

ENGINEERS IN CHARGE.

Lieut. Col. McFarland, 1875-'83. Reports, '80, 2212; '81, 2447; '82, 2449; '83, 1951.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1948; '84, 2143, 2147; '85, 2278.

Capt. E. Maguire, 1885. Reports, '85, 2278; '86, 1892.

Capt. C. F. Palfrey, 1886-'—. Report, '87, 2381, 2386.

ASSISTANT.

W. P. Judson. Report, '82, 2452.

Operations.

1879-'80. 747 linear feet crib-work sunk in extension of new breakwater and 677 linear feet of same covered with superstructure; minor repairs made to new breakwater, southeast portion of old breakwater heavily ripped; 400 linear feet of northern half rebuilt from foundation up, and 220 feet more repaired; also repairs to derricks and working plant, '80, 2212, 2216.

1880-'81. 463 linear feet of crib-work added to east breakwater, '81, 2447.

1881-'82. 441 linear feet crib-work added to west breakwater, completing the same; 7 cribs sunk in extension of the east breakwater; channel deepened by dredging to 15 feet on west side of river, '82, 2450.

1882-'83. Extensive repairs to breakwater, Government wharf, and engineer property; 5,000 cubic yards material dredged from inner harbor, '83, 1948.

1883-'84. 32,194 cubic yards material dredged from inner harbor; repairs to breakwater and breaches therein, '84, 2144.

1884-'85. 1,929 cubic yards material dredged from inner harbor; west breakwater spur built; breach in breakwater arrested by construction of bulkheads on either side of the injured portion, '85, 2278, 2280.

1885-'86. Two partial breaches in the breakwater repaired; buttress built against parapet in harbor face, '86, 1892.

1886-'87. Lake face of west breakwater parapet strengthened; superstructure on shore-arm repaired; repairs to lake-arm and east breakwater, '87, 2383.

Physical Characteristics.

Measurements of height, velocity, and force of waves, '85, 2279.

Projects.

The earliest project was adopted in 1827 and proposed to inclose an area at the mouth of the river by extending piers from the shores into the lake and adjoining the outer ends of the piers with the shores by lateral breakwater, '74, i, 261, 263. This project was completed in 1869 and the work forms the present inner harbor.

From 1826 to 1869, inclusive, \$173,362.87 was appropriated. In 1870 the present project was adopted, and it consists of a breakwater 5,800 feet in length, parallel to the old west breakwater and about 1,100 feet in advance of it. The estimated cost was \$1,161,682, '70, 221; '86, 345. The project was modified in 1879, 1880, 1882, and 1883 by the proposed construction of an east breakwater 2,700 feet long, the reduction of 350 feet in the opening between the east end of the west breakwater and north end of light-house pier; the use of creosoted timber in repairs to the old breakwater, the construction of spurs along the outer face of the west breakwater, and the deepening by dredging of the inner harbor at the mouth of the river, '79, 1734; '86, 345. The amount appropriated from 1870 to 1886, inclusive, was \$1,162,250.

OSWEGO, N. Y.—Continued.**Projects—Continued.**

The Board of Engineers of 1887 recommended the removal of the part of the east breakwater already built, '87, 2391.

History of past projects, '87, 2381.

Surveys.**MAPS.**

Oswego Harbor, '80, 2216; '81, 2450.

OTTER CREEK, VT.—IMPROVEMENT OF.

(Continued from Vol. I, p. 405.)

Appropriations.

1872-'79	\$28,000
1880	2,000, '80, 560.
1881	2,000, '81, 726.
1882	2,000, '82, 712.

Total..... 34,000

1888..... 2,500, act of August 11, 1888.

Appropriations prior to 1880, '81, 725.

Contracts.

1881. L. Whitney, for dredging, at 30 cents per cubic yard, '82, 712.

1884. L. Whitney, for dredging, at 25 cents per cubic yard, '84, 2158.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 90; '81, 114; '82, 115; '83, 325; '84, 329; '85, 356; '86, 350; '87, 315.

ENGINEERS IN CHARGE.

Col. J. Newton, 1878-'80, '80, 90.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 559; '81, 725.

Maj. G. L. Gillespie, 1882-'83. Report, '82, 711.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1960; '84, 2158.

Maj. M. B. Adams, 1885-'— . Reports, '85, 2309; '86, 1905; '87, 2410.

ASSISTANT.

J. A. Gillespie. Report, '82, 712.

Operations.

1881-'82. 6,219 cubic yards material dredged from bars at Vergennes Basin and mouth of the creek, '82, 711.

1882-'83. 10,791 cubic yards material dredged from Vergennes Basin, Bull Brook, Smith's and Gage's bends, '83, 1960.

1883-'84. No operations, '84, 2158.

1884-'85. 11,773 cubic yards material dredged from Bull Brook Bend, '85, 2309.

1885-'87. No operations, '86, 1905; '87, 2410.

Projects.

The project proposed by Col. Newton in 1872 proposed the formation of a channel from Lake Champlain to Vergennes Basin 100 feet wide and 8 feet deep, with the formation of a basin at Vergennes. Estimated cost, \$58,146, '72, 273; '81, 725. In 1882 the project was modified to provide for rock removal at Steamboat Landing, near Vergennes, increasing the estimated cost to \$73,748.40, '82, 712. In 1884 it was further modified so as to provide for a change in the hitherto proposed channel at Bull Brook Bend so as to escape the removal of rock, '84, 2159.

Surveys.

Examination, 1881, '81, 725.

Examination of bars and special survey of Steamboat Landing, '82, 711.

Survey of Vergennes Reef, 1882, '82, 712.

Survey at Bull Brook Bend, 1884, '84, 2158.

OUACHITA AND BLACK RIVERS, LA. AND ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 406.)

Appropriations.

1871-'79	\$243,000
1880	8,000, '80, 1307.
1881	12,000, '81, 1417.

OUACHITA AND BLACK RIVERS, LA. AND ARK.—Continued.**Appropriations—Continued.**

1882	\$12,000, '82, 1557.
1884	15,000, '84, 1330.
1886	17,500, '86, 1352.

Total	307,500	
1888 { Ouachita and Black rivers, La. and Ark ..	20,000	} act of August 11, 1888.
{ Ouachita River, Ark., above Camden	9,000	
Statement of appropriations, '80, 1306; '87, 1457.		

Commerce.

Importance of improvement, '81, 1421.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 152; '81, 211; '82, 208; '83, 217; '84, 221, 227; '85, 235; '86, 230; '87, 195.

ENGINEERS.

Maj. W. H. H. Benyaard, 1873-'83. Reports, '80, 1305, 1307; '81, 1416; '82, 1556.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1155; '84, 1329, 1351, 1381, 1386.

Capt. E. Bergland, 1885-'86. Reports, '85, 1497; '86, 1351.

Capt. J. H. Willard, 1887-'—. Report, '87, 1455, 1487, 1495.

ASSISTANTS.

W. C. Melvin. Reports, '80, 1307; '81, 1418.

E. F. White. Reports, '81, 1417; '82, 1557; '83, 1157; '84, 1382.

P. C. Montgomery. Report, '84, 1351.

F. S. Burrowes. Report, '84, 1383.

Operations.

History of work, '86, 1351.

1879-'80. 400 snags removed from channel below Monroe, '80, 1305.

1880-'81. 456 snags and 4,159 trees removed from channel and banks of Upper Ouachita; dam at Catahoula Shoals rebuilt, '81, 1416.

1881-'82. 241 snags and logs removed and 6,210 trees cut down, '82, 1556.

1882-'83. 780 logs and snags destroyed; 900 trees, shore snags, and stumps removed; wreck of steam-boat Little Bob B removed, '83, 1155.

1883-'84. No operations for lack of funds, '84, 1329.

1884-'85. 677 snags pulled; 2,652 trees, stumps, and logs removed from channel, '85, 1419.

1885-'86. No operations, '86, 1352.

1886-'87. 465 snags and stumps removed and 267 trees cut, '87, 1456.

Plans.

In 1883 Capt. Miller did not consider that part of the river between Camden and Arkadelphia worthy of improvement nor the work a public necessity, '84, 1353.

In 1887 Capt. Willard considered this part of the river worthy of improvement to the extent of removing obstructions, '87, 1496.

In 1887 Capt. Willard did not consider that part of the river between the mouth and Camden worthy of improvement by locks and dams, '71, 340; '74, i, 352; '84, 1386; '87, 1468.

Projects.

The first appropriations were made with a view to the improvement of the river by means of a system of locks and dams, the estimated cost of which was \$1,163,083, '72, 346, 348, 370, 374; '73, 484.

A portion of the funds appropriated was expended under this project for material, surveys, etc., when it was abandoned in 1875, '75, i, 521; '80, 1306. The balance of the funds was expended in the purchase and operation of an iron-hulled snag-boat. The character of the improvement, viz, the removal of logs, snags, and similar obstructions, does not admit of a permanent improvement or definite estimate, '80, 1306; '84, 1386; '86, 231. By act of 1884 the Black River, Ark. and La., was placed under the same head as the Ouachita, '86, 1351.

Surveys.

Examination of Catahoula Shoals and vicinity, 1879, '80, 1307.

Examination of Ouachita River from Camden to Arkadelphia ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Miller.

Not recommended for improvement, '84, 1351.

Plan and estimate for continuing improvement of Ouachita River from its mouth to Camden, Ark., ordered by act of August 2, 1882. Made, 1882, under direction of Maj. Miller, '84, 1386.

Re-examination with a view to slackwater from Camden to mouth ordered by act of August 5, 1886. Made under direction of Capt. Willard, '87, 1487.

OUACHITA AND BLACK RIVERS, LA. AND ARK.—Continued.**Surveys—Continued.**

Examination of harbors of Monroe and Trenton, La., on Ouachita River, with view to prevent caving of banks ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Miller, '84, 1831.

Examination above Camden ordered by act of August 5, 1836. Made under direction of Capt. Willard, '87, 1495.

OUTLET TO LAKE WINNEPESAUKEE, N. H.—IMPROVEMENT OF.

(See WINNEPESAUKEE (WINNIPISEOGER) LAKE, N. H.—IMPROVEMENT OF.)

OUTLET TO WOLF LAKE, IND.—RESURVEY OF.

(See WOLF LAKE, IND.—RESURVEY OF OUTLET TO.)

OWENSBOROUGH HARBOR, KY.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 284.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1831.

ASSISTANT.

G. W. Goethals. Report, '85, 1831.

Plans.

In 1884 Lieut. Col. Merrill did not consider the harbor worthy of improvement, '85, 1831.

Surveys.

Examination ordered by act of July 5, 1834. Made under direction of Col. Merrill, '85, 1831.

OWL'S HEAD HARBOR, ME.—EXAMINATION OF.

(Continued from Vol. I, p. 408.)

Appropriations.

1836-'79..... \$17,902. 11.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 60.

ENGINEER IN CHARGE.

Col. C. E. Blunt. Report, '85, 476.

Plans.

In 1834 Col. Blunt considered that the harbor required no artificial improvement, '85, 478.

Surveys.

Examination ordered by act of July 5, 1834. Made under direction of Col. Blunt, '85, 476.

PACIFIC COAST HARBOR OF REFUGE.—EXAMINATION FOR.

(See HARBOR OF REFUGE ON PACIFIC COAST.)

PADUCAH, KY.—EXAMINATION FOR ICE-HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '85, 284; '87, 243.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1834. Reports, '85, 1830; '87, 1833.

ASSISTANTS.

Lieut. G. W. Goethals. Report, '85, 1830.

Lieut. L. H. Beach. Report, '87, 1833.

Physical Characteristics.

Washing of river banks, '85, 1830.

Plans.

In 1834 and 1837 Lieut. Col. Merrill reports that the harbor is unworthy of improvement from a commercial stand-point, '85, 1830; '87, 1833.

Surveys.

Examination ordered by act of July 5, 1834. Made under direction of Lieut. Col. Merrill, '85, 1830.

PAGAN CREEK, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 409.)

Appropriations.

1840..... \$5,000, '80, 821.

1881..... 5,000, '81, 991.

Contracts.

1880. H. E. Culpepper, for dredging, at 16½ cents per cubic yard, '81, 991.

1881. J. Caler & Co., for dredging, at 23 cents per cubic yard, '82, 1077.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 119; '81, 159; '82, 155; '83, 162.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'81. Report, '80, 820.

Capt. J. Mercur, June 14, 1881-'83. Reports, '81, 990; '82, 1076; '83, 842.

Operations.

1880-'81. 6,662 cubic yards material dredged from bars at Smithfield, '81, 991.

1881-'82. 34,631 cubic yards material dredged from bars and at mouth of creek, '82, 1076.

1882-'83. No operations for lack of funds, '83, 842.

Projects.

By S. T. Abert, 1875, for excavation of a channel 60 feet in width and 6½ to 7 feet deep through four bars between the town of Smithfield and mouth of creek, a distance of 5 miles. Estimated cost, \$28,380, '75, ii, 157; '80, 820.

PALMYRA LAKE, LA. AND MISS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 22.

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '84, 1370.

ASSISTANT.

T. M. Farrell. Report, '84, 1371.

Physical Characteristics.

Description of lake, '84, 1370.

Plans.

In 1883 Maj. Miller did not consider the lake worthy of improvement nor the work a public necessity, '84, 1371.

Surveys.

Examination ordered by act of August 2, 1832. Made, 1833, under direction of Maj. Miller, '84, 1370.

PAMLICO AND TAR RIVERS, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, pp. 409 and 538.)

Appropriations.

1836-'79, Pamlico River.....	\$28,000
1879 Tar River.....	3,000
1880.....	9,000, '80, 838.
1881.....	8,000, '81, 1002.
1882.....	10,000, '82, 1084
1884.....	5,000, '84, 1036.
1886.....	5,000, '86, 967.

Total.....	68,000
------------	--------

1888.....	10,000, act of August 11, 1888.
-----------	---------------------------------

Commerce.

Increase in shipments, '83, 850.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 123; '81, 162; '82, 158; '83, 164; '84, 168; '85, 161; '86, 156; '87, 123.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'81. Report, '80, 836, 838.

Capt. J. Mercur, 1881-'84. Reports, '81, 1001; '82, 1083; '83, 843.

Capt. F. A. Hinman, 1884. Reports, '84, 1036; '85, 1041; '86, 966.

Capt. W. H. Bixby, 1886-'—. Report, '87, 1010.

ASSISTANTS

W. H. James. Report, '80, 837.

J. P. Darling. Reports, '81, 1002; '82, 1084; '83, 849; '84, 1036.

E. D. Thompson. Report, '87, 1012.

Operations.

1879-'80. Channel 70 feet wide and 10 feet deep formed through Stumpy Shoal by removal of snags and logs, '80, 836.

1880-'81. 1,197 stumps removed from the dredged channel in the Pamlico; 22 pile and brush jetties aggregating 3,233 linear feet built in Tar River; also 3,088 stumps and snags removed from same locality, '81, 1001.

1881-'82. 6,503 cubic yards of material and 1,215 stumps removed from the Pamlico; 12 jetties aggregating 1,436 linear feet built in the Tar River, '82, 1084.

1882-'83. Logs and stumps removed from the Tar River; 160 linear feet of jetty built at Red Bank on the Pamlico; working plant repaired, '83, 848, 489.

1883-'84. 1,855 linear feet of jetty built on the Tar River; 1,224 logs, stumps, trees, and snags removed, '84, 1037.

1884-'85. 1,373 logs, stumps, and snags, 5 pile bridges, and 149 trees removed from Tar River, '85, 1041.

1885-'86. 681 logs, trees, snags, and similar obstructions removed from the Tar River, '86, 966.

1886-'87. 2,923 logs, snags, stumps, and jetty piles removed from the river channel, 700 trees cut, and 2 flat-boat wrecks removed, '87, 1011.

Projects.

Previous to 1880 the Pamlico and Tar rivers were under separate appropriations, the aggregate of which was \$31,000, '80, 838.

The project for this improvement proposes the removal of obstructions in both rivers and widening, deepening, and straightening of the Pamlico to Washington so as to obtain a 9-foot low-water channel, thence a 3-foot channel to Greenville, and thence 20 inches deep to Tarborough, at an estimated cost of \$75,000, '76, 1,363; '79, 700, 702; '87, 1010.

Surveys.**MAPS.**

'80, 836.

Tar River, '87, 1012.

PAMUNKY RIVER, VA.—IMPROVEMENT OF.**Appropriations.**

1880.....	\$2,500, '80, 775.
1881.....	2,500, '81, 970.
1882.....	2,500, '82, 1038.
1883.....	5,000, '86, 918.

Total	12,500
-------------	--------

1888.....	3,000, act of August 11, 1888.
-----------	--------------------------------

PAMUNKY RIVER, VA.—Continued.**Contracts.**

1887. F. A. Smith, for dike construction, at \$3.55 per linear foot, '87, 943.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 115, 125; '81, 155; '82, 150; '83, 156; '84, 158; '85, 148; '86, 144; '87, 110.

ENGINEER IN CHARGE.

Capt. C. B. Phillips, 1879-'80. Report, '80, 904.

S. T. Abert, U. S. Agent, 1880-'—, Reports, '80, 773; '81, 970; '82, 1036; '83, 819; '84, 992; '85, 982; '86, 917; '87, 942.

ASSISTANT.

J. M. Wolbrect. Report, '80, 904.

Operations.

1880-'81. 600 logs and snags removed from the channel, '81, 971.

1881-'82. 1,721 logs, snags, and trees and 8 wrecks removed, improving 20 miles of river, '82, 1037.

1882-'86. No operations from lack of funds, '83, 819; '84, 992; '85, 982; '86, 918.

1886-'87. 298 linear feet of dike built, '87, 943.

Physical Characteristics.

Description of river and obstacles therein, '80, 773.

Projects.

By Capt. Phillips, 1880, for improvement of river by dredging through sand and gravel bars and removal of snags, logs, and similar obstructions, forming a channel 40 feet wide and from 5 to 6 feet deep at low water. Estimated cost, \$19,541, '80, 905, 906. Increased in 1885 to provide for additional work on lower bars to \$28,300, '85, 983; '87, 943.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 904.

MAPS.

Skidmore's and Foxes bars, '85, 982; '87, 942.

PASCAGOULA HARBOR, MISS. (See HORN ISLAND PASS, MISS.)**PASCAGOULA RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 411.)

Appropriations.

1827-'79	\$65,400
1880	20,000, '80, 1099.
1881	4,000, '81, 1216.
1882	8,000, '82, 1299.
1884	3,000, '84, 1215.
1886	*25,000, '86, 1205.

Total 125,400

1888..... 27,000, act of August 11, 1888.

Statement of appropriations, '84, 1214; '87, 1331.

Commerce.

Benefit resulting from improvement, '81, 1216.

Contracts.

1880. S. N. Kimball, for dredging, at 34½ cents per cubic yard, '80, 1099. W. G.

Mitchell, for dredging, at 27 cents per cubic yard, '81, 1216.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140; '81, 183, 189; '82, 185, 186; '83, 197; '84, 205; '85, 211; '86, 209, 211; '87, 175.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1878-'—. Reports, '80, 1098; '81, 1214; '82, 1298, 1324; '83, 1025; '84, 1214; '85, 1358; '86, 1203; '87, 1330.

*\$5,000 of which is reappropriated from an appropriation for Horn Island Pass, made in 1884, '86, 454.

PASCAGOULA RIVER, MISS.—Continued.**Engineers—Continued.****ASSISTANTS.**

T. L. Harrison. Report, '82, 1325.

R. Rauchenstein. Report, '86, 1217.

Operations.

1830-'81. 75,155 cubic yards material dredged from the channel, '81, 1215.

1831-'82. 106,341 cubic yards material dredged from the channel, '82, 1293.

1882-'83. 1,083 snags and 5,687 trees cut and removed, '83, 1028.

1883-'84. 953 snags and 4,000 trees removed, '84, 1215.

1884-'85. 1,115 snags removed from river, '85, 1359.

1885-'87. No operations, '86, 1204; '87, 1332.

Plans.

By Maj. Damrell, for improvement of harbor at Pascagoula, by excavation of a channel 100 feet wide and 21 feet deep through "the Pass." Estimated cost, \$328,816, '82, 1324.

Projects.

The project of 1879 proposed the formation of a dredged channel through the bar at the mouth 200 feet wide and 7 feet deep, and the removal of snags and overhanging trees from the river for its entire length. Estimated cost, \$53,800, '74, i, 757; '79, 834.

From 1878 to 1885, inclusive, \$59,000 was appropriated, '86, 1204.

In 1886 it was proposed to form, by dredging, a channel 12 feet deep from the mills at Moos Point to the anchorage in the Bay, a distance of 11½ miles. Estimated cost, \$78,100, '86, 1217.

Surveys.

For harbor at Pascagoula ordered by act of March 3, 1831. Made, 1882, under direction of Maj. Damrell, '82, 1324.

Of Pascagoula River, from mills at Moos Point down to anchorage in Bay, ordered by act of July 5, 1884. Made, 1884, under direction of Maj. Damrell, '86, 1215.

PASQUOTANK RIVER, N. C., above mouth of canal—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 164.

ENGINEER IN CHARGE.

Capt. F. A. Hinman. Report, '85, 1049.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Hinman, '85, 1050.

PASSAIC RIVER, N. J., above Newark—IMPROVEMENT OF.

(Continued from Vol. I, p. 412.)

Appropriations.

1872-'79	\$112,000
1880	2,000, '80, 536.
1882	7,000, '82, 684.
1884	3,000, '84, 739.
1886	2,250, '86, 800.

Total 126,250.

1888..... 7,500, act of August 11, 1888.

Appropriations prior to 1880, '80, 536.

Contracts.

1882. F. Pidgeon, for dredging, at 3¼ cents per cubic yard, '84, 739.

1884. R. Parrott, for dredging, at 49 cents per cubic yard, '85, 746.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 86; '81, 103; '82, 109; '83, 105; '84, 111, 122; '85, 102; '86, 111; '87, 63.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 535; '81, 627.

Lieut. Col. G. L. Gillespie, 1882-'85. Reports, '82, 624; '83, 571; '84, 737, 780, 782; '85, 744.

PASSAIC RIVER, N. J., above Newark—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE—Continued.**

Lieut. Col. McFarland, 1886. Report, '86, 792.

Lieut. G. McC. Derby, 1887.—. Reports, '87, 763.

ASSISTANT.

A. R. Doerflinger. Report, '84, 784.

Operations.

History of the work, '86, 794.

1879-'80. 328 cubic yards stone removed from the channel, '80, 535.

1880-'81. Stone abutment removed at expense of New York, Lake Erie and Western Railroad, '81, 687.

1881-'82. No operations for lack of funds, '82, 684.

1882-'83. No operations, '83, 571.

1883-'84. 19,190 cubic yards sand and gravel removed from shoals between Erie and Midland Railroad bridges, '84, 738.

1884-'85. 1,945 cubic yards material dredged from Lime Kiln and Middle bars.

1885-'87. No operations, '86, 796; '87, 764.

Physical Characteristics.

Description of river.

Plans.

By Maj. G. L. Gillespie, 1884, for extension of improvement from Passaic to Paterson, at an estimated cost of from \$380,000 to \$611,000, '84, 782, 784.

Private and Corporate Work.

Occupation of river between Passaic and Paterson by a corporate company, '84, 780, 782, 784.

Projects.

By Lieut. Col. Newton, 1872, for partial improvement of river above Newark, so as to afford a channel 6 feet deep at low water to the head of navigation at Passaic, by means of dredging and dike construction. Estimated cost, \$123,924, '72, 805, 807; '80, 536; '86, 793.

In 1885 the project was amended to provide for a channel 7½ feet deep from the Erie to the old Midland Railroad Bridge, '87, 764.

From 1872 to 1886, inclusive, \$126,250 was appropriated, when it was estimated that \$7,512 would be required for completion of project, '86, 796, 797.

Surveys.

Between Passaic and Paterson ordered by act of August 2, 1882. Made, 1884, under direction of Maj. Gillespie, '84, 780, 782.

MAPS.

'81, 688; '87, 766.

PASSAIC RIVER, N. J., below Newark—IMPROVEMENT OF.

(Continued from Vol. I, p. 412.)

Appropriations.

1872-'79.....	\$112,000
1880.....	30,000, '80, 536.
1881.....	50,000, '81, 689.
1882.....	43,000, '82, 686.
1884.....	25,000, '84, 741.
1886.....	24,000, '86, 800.
Total.....	284,000
1888.....	27,500, act of August 11, 1888.

Commerce.

Necessity for completion of improvement, '83, 574.

Contracts.

1880. H. Du Bois & Sons, for pile-dike construction, '81, 690.

1881. E. M. Payn, for dredging, at 14 cents per cubic yard, '81, 690. H. Du Bois & Sons, for pile-dike construction, '81, 690. E. Brainard, jr., for dredging, at 10½ cents per cubic yard, '82, 686.

1882. Morris & Cummings, for dredging, at 22½ cents per cubic yard, '83, 574.

1884. H. Du Bois & Sons, for dredging, at 10 cents per cubic yard, '85, 748.

1886. P. S. Ross, for pile-dike construction, at \$11.50 per linear foot, '87, 767.

PASSAIC RIVER, N. J., below Newark—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 86; '81, 109; '82, 110; '83, 106; '84, 112; '85, 103; '86, 112; '87, 68.

ENGINEERS IN CHARGE.

Col. J. Newton, to June 25, 1880. Report, '80, 537.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 536; '81, 688.

Lieut. Col. G. L. Gillespie, 1882-'85. Reports, '82, 684; '83, 572; '84, 740; '85, 746.

Lieut. Col. W. McFarland, 1885-'86. Report, '86, 792.

Lieut. G. McC. Derby, 1886-'— . Report, '87, 764.

Operations.

History of work, '80, 538.

1880-'81. 2,000 linear feet of diking built at mouth of river; 19,263 cubic yards material dredged from channel, '81, 649.

1881-'82. 134,589 cubic yards material dredged from channel; 2,003 linear feet of pile-diking built, '82, 689.

1882-'83. 228,993 cubic yards material dredged from the channel, '83, 572.

1883-'84. 110,221 cubic yards material dredged from the channel, '84, 740.

1884-'85. 699 linear feet of diking built; 34,509 cubic yards material dredged, '85, 747.

1885-'86. 110,221 cubic yards material dredged; repairs to dike, '86, 799.

1886-'87. 1,000 linear feet of pile-dike built, '87, 765.

Projects

By Col. Newton, 1880, for formation of a channel 200 feet wide and 10 feet deep at mean low water from the Pennsylvania Railroad Bridge at Newark to Newark Bay, by dredging and construction of 15,800 linear feet of pile-dike. Estimated cost, \$232,875, '80, 537; '84, 741.

By Lieut. Col. Gillespie, 1884, for extension of channel through shoals in Newark Bay, by dredging and the extension of the dike at the mouth of the river about 8,000 feet. Estimated cost, \$121,000, increasing the original estimate to \$353,875, '84, 741; '87, 765, 766.

Surveys.**MAPS.**

'81, 688; '82, 686; '87, 766.

PASSO CAVALLO, TEX. (See MATAGORDA BAY.)**PATAPSCO RIVER, MD. (See BALTIMORE HARBOR.)****PATCHOGUE RIVER, N. Y.—SURVEY OF.****Commerce.**

Commerce and navigation to be benefited by improvement, '81, 674.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 108; '87, 67.

ENGINEERS IN CHARGE.

Col. J. Newton. Report, '81, 674.

Lieut. Col. McFarland, 1887. Report, '87, 759.

ASSISTANTS.

R. H. Talcott. Report, '81, 674.

M. Kingsley. Report, '87, 760.

Plans.

By Col. Newton, 1880, for securing a 6-foot low-water channel from head of navigation to 6-foot curve in Great South Bay, by dredging and construction at mouth of river of two parallel timber dikes, aggregating 2,400 linear feet. Estimated cost, \$42,320, '81, 674, 675.

PATCHOGUE RIVER, N. Y.—Continued.**Plans—Continued.**

By Lieut. Col. McFarland, 1886, for securing a 6-foot low-water channel within the above limits, by dredging and the protection of the cut by a dike on the west side. Estimated cost, \$40,000, '87, 760.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Newton, '81, 674.

Examination of mouth of Patchogue River ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. McFarland, '87, 759.

PATUXENT RIVER, MD.—FROM BENEDICT TO HILL'S LANDING.

Survey ordered by act of August 5, 1886, '87, 114. [\$5,000 appropriated by act of August 11, 1888.]

PAWCATUCK RIVER, R. I. AND CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 415.)

Appropriations.

1871-'79.....	\$50,000
1886.....	12,000, '86, 617.
1888.....	10,000, act of August 11, 1888.

Contracts.

1886. A. J. Beardsley & Son, for dredging, at 12½ cents per cubic yard, '87, 566.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 60; '87, 42.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Elliot, 1884-'87. Reports, '85, 622; '86, 616.

Maj. W. R. Livermore, 1887-'— Report, '87, 565.

Operations.

1871-'76. Dredging channel below wharves, '87, 565.

1886-'87. Under project of 1885 19,721 cubic yards dredged from channels, '87, 556.

Physical Characteristics.

Description of river, '85, 622.

Projects.

From 1871 to 1875, inclusive, \$50,000 was appropriated and expended upon the excavation of a channel 5½ feet deep at low water and 75 feet wide below the wharves, and from 35 to 40 feet wide between the upper and lower wharves, '71, 741-744; '75, ii, 296; '87, 565.

Surveys.

Examination and survey ordered by act of July 5, 1884. Made, 1884 and 1885, under direction of Lieut. Col. Elliot, '85, 622, 623.

MAPS.

'85, 624.

PAWTUCKET RIVER, R. I.—IMPROVEMENT OF.

(Continued from Vol. I, p. 416.)

Appropriations.

1867-'79.....	\$52,000
1884.....	50,000, '84, 608.
1886.....	30,000, '86, 599.
Total.....	132,000
1888.....	35,000, act of August 11, 1888.

PAWTUCKET RIVER, R. I.—Continued.**Commerce.**

Importance of improvement, '80, 378; '83, 483; '85, 601.

Obstruction from bridges, '81, 656; '82, 555.

Removed in 1883, '83, 78, 480.

Contracts.

1884. Brainard & Benton, for dredging, at 21 cents per cubic yard, '85, 593.

1886. E. Brainard, for dredging, at 25 cents per cubic yard, '87, 549.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 74; '81, 81; '82, 81; '83, 78; '84, 85; '85, 73; '86, 73; '87, 36.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1870-'82. Reports, '80, 377; '81, 556; '82, 555.

Lieut. Col. G. H. Elliot, 1882-'87. Reports, '83, 480; '84, 608, 609; '85, 592; '86, 598.

Maj. W. R. Livermore, 1887-'— . Report, '87, 548.

ASSISTANT.

H. A. Bentley. Report, '80, 378.

Legislation.

Act of State of Rhode Island providing for clearing channel of river from obstructions and for construction of bridge near site of former bridge, '84, 614.

Operations.

History of past operations, '80, 377.

Original project completed in 1875, '76, i, 207; '80, 81.

1884-'85. Preparations for dredging, '85, 593.

1885-'86. 212,735 cubic yards material dredged from channel, '85, 599.

1886-'87. 31,069 cubic yards material dredged from channel, '87, 548.

Physical Characteristics.

Tidal observations, '80, 379.

Description of river, '84, 610.

Changes since 1873, '84, 611.

Projects.

The projects of 1868 to 1874 proposed the formation, by dredging, of a channel 7 feet deep at low water and 75 feet wide from the mouth to the city of Pawtucket, '67, 449; '68, 746; '70, 450; '73, ii, 290. This work was completed in 1875, '76, i, 49, 207; '80, 81; '83, 82; '84, 609.

By Lieut. Col. Elliot, 1884, for the formation of a channel, by rock removal and dredging, 100 feet wide and 12 feet deep at mean low water from the Red Bridge to the rock cutting at Pawtucket; thence a channel to Pawtucket Bridge 40 feet wide and 12 feet deep. Estimated cost, \$382,478, '84, 85, 613; '85, 593; '87, 548.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Lieut. Col. Elliot, '84, 609.

PAWTUCKET RIVER, R. I.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 91.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '84, 633.

Plans.

By Maj. J. W. Barlow, 1882, for removal of boulders from the entrance to the river, '84, 633.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Barlow, '84, 633.

PEA RIVER, ALA.—SURVEY OF.

(Continued from Vol. I, p. 417.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 140.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1879. Report, '80, 1120.

ASSISTANT.

H. Haines. Report, '80, 1120.

PEA RIVER, ALA.—Continued.**Physical Characteristics.**

Description of river and obstructions therein, '80, 1120.

Plans.

By Maj. Damrell, for improvement of navigation during high water from Geneva to Elba, by construction of 2 crib-work locks and dams, 300 linear feet of dike, 500 linear feet of brush dam, dredging, and snag removal. Estimated cost, \$56,750, '80, 1121.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Damrell, '80, 1120.

PEARL RIVER, MISS., between Edenburgh and Carthage—IMPROVEMENT OF.**Appropriations.**

1884..... \$2,500, '85, 1372.
 1886..... 2,250, '86, 1215.
 1888..... 5,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 216; '85, 213; '86, 211; '87, 176.

ENGINEERS IN CHARGE.

Maj. A. M. Stickney, 1882-'85. Report, '84, 1286.

Maj. A. N. Damrell, 1885-'—. Reports, '85, 1371; '86, 1214; '87, 1334.

ASSISTANT.

W. H. Hoffman. Report, '84, 1287.

Operations.

1884-'85. 400 snags, logs, and stumps removed, 1,048 trees cut, and 6,491 yards of bank cleared of brush, '85, 1371.

1885-'86. 70 stumps blasted and removed, 100 sunken logs and trees cut, and 172 overhanging trees removed, '86, 1214.

1886-'87. 1,143 snags, stumps, and logs and 760 overhanging trees removed, '87, 1335.

Physical Characteristics.

Description of the river and its obstructions, '84, 1288.

Projects.

By Maj. Stickney, 1884, for improvement of river between Carthage and Edenburgh by removal of snags, logs, and similar obstructions. Estimated cost, \$13,469, '84, 1289; '85, 1371; '87, 1334.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Maj. Stickney, '84, 1286.

PEARL RIVER, MISS., between Carthage and Jackson—IMPROVEMENT OF.

(Continued from Vol. I, p. 417.)

Appropriations.

1879..... \$6,000
 1880..... 7,500, '80, 1155.
 1881..... 2,500, '81, 1277.
 1882..... 2,500, '82, 1370.
 1886..... 2,250, '86, 1213.

Total 20,750
 1888..... 2,500, act of August 11, 1888.

Commerce.

Amount of transportation, '83, 1100.

Contracts.

1879. J. S. Hamilton & Co., for removal of obstructions, '80, 1154.

1880. J. S. Hamilton, for removal of obstructions, '81, 1276.

1881. J. S. Hamilton, for removal of obstructions, '82, 1369.

PEARL RIVER, MISS.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 142; '81, 191; '82, 187; '83, 205; '84, 209; '85, 213; '86, 210; '87, 177.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1878-'82. Reports, '80, 1151; '81, 1276.

Maj. A. Stickney, 1882-'85. Reports, '82, 1368; '83, 1099; '84, 1259.

Maj. A. N. Damrell, 1885-'—. Reports, '85, 1369; '86, 1212; '87, 1336.

ASSISTANT.

H. C. Collins. Report, '84, 1260.

Operations.

1879-'80. Removal of obstructions, trees, etc., commenced, '80, 1154.

1880-'81. Removal of obstructions continued, '81, 1276.

1881-'82. Removal of obstructions continued, '82, 1369.

1882-'83. No operations, '83, 1100.

1883-'84. Removal of obstructions completed to within 5 miles of Carthage, '84, 1261.

1884-'85. 10,812 snags, roots, logs, and stumps removed from the river; also 6,851 overhanging trees cut and 700 cubic yards bank protected with brush and willow, '85, 1370.

1885-'86. No operations, '86, 1213.

1886-'87. 721 snags, logs, and stumps and 216 overhanging trees removed, '87, 1337.

Projects.

By Maj. Howell, 1879, for improvement of the river between Carthage and Jackson by removal of snags, logs, overhanging trees, willows, etc. Estimated cost, \$21,000, '79, 878, 900; '87, 1336. Estimate revised in 1887 to \$50,000, '87, 1336.

PEARL RIVER, MISS., below Jackson—IMPROVEMENT OF.**Appropriations.**

1880..... \$30,000, '80, 1155.

1881..... 25,000, '81, 1279.

1882..... 15,000, '82, 1372.

1884..... 10,000, '84, 1263.

1886..... 13,125, '86, 1210.

Total 93,125

1888..... 15,000, act of August 11, 1888.

Commerce.

Commercial statistics, '83, 1102.

Benefits derived from river improvement, '86, 1209.

Contracts.

1880. S. N. Kimball, for removal of obstructions, '81, 1278.

1881. G. A. Meyer, for removal of obstructions, '82, 1371.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 142; '81, 192; '82, 188; '83, 206; '84, 209; '85, 212; '86, 210; '87, 177.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1878-'82. Reports, '80, 1155; '81, 1277.

Maj. A. Stickney, 1882-'84. Reports, '82, 1370; '83, 1101; '84, 1262.

Maj. A. N. Damrell, 1884-'—. Reports, '85, 1363; '86, 1207; '87, 1339.

Operations.

1881-'82. 104 miles of river below Jackson cleared of obstructions, '82, 1370.

1882-'83. 191 miles of river below Jackson cleared of snags, trees, logs, and similar obstructions, '83, 1101.

1883-'84. Removal of obstructions continued, '84, 1262.

1884-'85. 7,563 snags, stumps, logs, etc., 1,865 standing and overhanging trees, and 7,360 cubic yards sand and clay removed from the river, '85, 1365.

1885-'86. 5,876 stumps, roots, snags, logs, and trees, 8,382 overhanging trees, and 2,752 cubic yards clay and sand removed, '86, 1209.

1886-'87. Summary of work done, '87, 1340.

PEARL RIVER, MISS.—Continued.**Projects.**

By Maj. Howell, 1879, for improvement of the river from Jackson to the mouth by removal of all trees, snags, logs, and similar obstructions to a depth of 5 feet below low-water mark, also by removal of overhanging trees from the banks. Estimated cost, \$95,940, '80, 1155; '87, 1339.

Project modified in 1885 to provide for dredging a channel 12 feet deep at mean low water over the bar at the mouth of East Pearl River, '85, 1367; '87, 1341. Amount appropriated from 1880 to 1886, inclusive, \$93,125. Amount estimated to complete project, \$70,000, '87, 1339, 1342.

PEAS CREEK (Pease), FLA. (See CHARLOTTE HARBOR, FLA.)**PEASE RIVER, FLA.—IMPROVEMENT OF.**

(See also MANATEE RIVER, FLA.)

Appropriations.

1881.....	\$7,000, '81, 1192.
1882.....	4,000, '82, 1277.
1886.....	5,000, '86, 1147.
1886.....	*2,000, '87, 1239.

Total 18,000

Commerce.

Irregular and desultory, '85, 1269.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140; '81, 185; '82, 181; '83, 193; '84, 201; '85, 196; '86, 195; '87, 158.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1879-'85. Reports, '80, 1100; '81, 1198; '82, 1276; '83, 1004; '84, 1196.

Capt. W. T. Rossell, 1885-'86. Report, '85, 1268.

Lieut. W. M. Black, 1886-'—. Reports, '86, 1146; '87, 1237.

ASSISTANT.

J. L. Meigs. Report, '80, 1101.

Operations.

1882-'83. 36 miles of river cleaned of trees, snags, logs, and similar obstructions, '83, 1005.

1883-'84. 1,617 logs and snags removed from the channel; 306 trees felled and 804 cubic yards rock removed, '84, 1197.

1884-'87. No operations, '85, 1269; '86, 1147; '87, 1238.

Physical Characteristics.

Description, '86, 1146.

Projects.

By Maj. Damrell, 1880, for improvement of Pease Creek from its mouth to Fort Meade, by removal of snags, sunken logs, overhanging trees, and loose rocks, securing a high-water navigable channel during nine months in the year. Estimated cost, \$17,000, '80, 1100, 1101.

Surveys.

Examination ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Damrell, '80, 1100.

PECATONIA RIVER, WIS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 244.

ENGINEER IN CHARGE.

Maj. A. Mackenzie. Report, '84, 1593.

*Allotted from Manatee River, '87, 1238.

PECATONIA RIVER, WIS.—Continued.**Physical Characteristics.**

Description of river, '84, 1593.

Plans.

In 1882 Maj. Mackenzie did not consider the river worthy of improvement nor the work a public necessity, '84, 1594.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Mackenzie, '84, 1593.

PECONIC RIVER, N. Y.—SURVEY OF.

(Continued from Vol. I, p. 417.)

Appropriations.

1871-'79 \$25,000

Commerce.

Justification of improvement, '84, 682.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 99.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '84, 681, 682.

ASSISTANT.

H. N. Babcock. Report, '84, 683.

Operations.

History of past operations, '84, 683.

Plans.

By Maj. Barlow, 1883, for the formation of a dredged channel 4 feet deep at mean low water from the mouth of Mud Creek to Riverhead. Estimated cost, \$29,000, '84, 682.

Surveys.

Ordered by act of August 2, 1882. Made under the direction of Maj. Barlow, '84, 682.

PEE DEE RIVER, GREAT, S. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 418.)

Appropriations.

1880 \$7,000, '80, 845.

1881 6,000, '81, 1030.

1882 6,000, '82, 1107.

1884 8,000, '84, 1047.

1886 20,000, '86, 170.

Total 47,000

1888 20,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 166; '82, 162; '83, 169; '84, 174; '85, 172; '86, 169; '87, 135.

ENGINEERS IN CHARGE.

Capt. C. B. Philips, 1879-'81. Report, '80, 844.

Capt. J. Mercur, 1881-'84. Reports, '81, 1029; '82, 1107; '83, 866.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1047.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1100; '86, 1017; '87, 1070.

ASSISTANTS.

C. W. Forster. Report, '80, 846.

H. Heth. Reports, '81, 1029; '82, 1108; '83, 867.

R. Whitford. Reports, '85, 1101; '86, 1019; '87, 1072.

Operations.

1880-'81. 286 logs and trees removed from river channel at Pocket Landing, '81, 1029.

PEE DEE RIVER, GREAT, S. C. —Continued.**Operations—Continued.**

- 1881-'82. Removal of snags, trees, and obstructions continued, '82, 1107.
 1882-'83. Removal of sunken trees, logs, and obstructions continued, opening the river for an additional distance of 50 miles, '83, 866.
 1883-'84. No operations, '84, 1047.
 1884-'85. 604 logs, snags, and stumps cleared from the channel, improving navigation over 209 miles of river, '85, 1100.
 1885-'86. No operations, '86, 1018.
 1886-'87. 1,564 snags, logs, and stumps, and 2,023 trees removed from the river and its banks, '87, 1071.

Physical Characteristics.

Description of river and its obstructions '80, 846.

Projects.

By Capt. Phillips, 1880, for improvement of Great Pee Dee River, by removal of obstructions, natural and artificial, so as to secure a navigable depth of 9 feet as high as Smith's Mills, about 46 miles above the confluence of the Pee Dee and Waccamaw rivers, and from thence a depth of $3\frac{1}{4}$ feet as high as the turn of Cheraw, a distance of 149 miles above the confluence of the two rivers above mentioned, '80, 124, 845.

From 1880 to 1886, inclusive, \$47,000 was appropriated when it was estimated that \$70,000 would be required to complete the project, '86, 170; '87, 1071.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 845.
 Of river, 1886, '86, 1018.

PEE DEE RIVER, LITTLE, S. C.—EXAMINATION OF.

[\$5,000 appropriated by act of August 11, 1888.]

Commerce.

Present and prospective, '87, 1114.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 139.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1887. Report, '87, 1111, 1113.

Physical Characteristics.

Description, '87, 1111.

Plans.

By Capt. W. H. Bixby, 1887, for improvement of the river by the removal of snags, trees, and similar obstructions, clearing it for a 4-foot draught steam navigation from its mouth to the Lumber River, and thence for a 4-foot draught poleboat navigation to Little Rock, S. C. Estimated cost, \$50,000, '87, 1114.

Surveys.

Ordered by act of August 5, 1886. Made, 1887, under direction of Capt. W. H. Bixby, '87, 1113.

PEEKSKILL HARBOR, on Hudson River, N. Y.—SURVEY OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 106.

ENGINEER IN CHARGE.

Col. J. Newton. Report, '84, 718.

Commerce.

Statistics, '84, 720.

Plans.

By Col. Newton, 1883, for excavation of a channel 10,000 feet long, 100 feet wide, and 8 feet deep at mean low water. Estimated cost, \$29,278, or one 10 feet deep, at \$50,611; also for construction of 1,400 linear feet of diking, at a cost of \$137,000, '84, 719.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under direction of Col. Newton, '84, 718.

PENOBSCOT RIVER, ME. (See BANGOR HARBOR AND PENOBSCOT RIVER, ME.)

PENSACOLA HARBOR, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 421.)

Appropriations.

1878-'79	\$30,000
1880.....	40,000, '80, 1068.
1881.....	20,000, '81, 1176.
1882.....	50,000, '82, 1257.
1884.....	55,000, '84, 1164.
1886.....	20,000, '86, 1181.

Total 215,000

1888..... 35,000, act of August 11, 1888.

Commerce.

Restrictions of present harbor depth upon large vessels, '82, 1257.

Commerce of Pensacola, '85, 1325.

Contracts.

1881. E. H. Farquhar, for dredging, at 40 cents per cubic yard, '82, 1255. Annulled, '83, 969. D. F. Sullivan, for rock ballast, at \$1 per ton, '82, 1256. W. H. Baker, for brush, at \$1.25 per cord, '82, 1256.
 1882. S. N. Kimball, for dredging, at 79 $\frac{1}{2}$ cents per cubic yard, '83, 969.
 1884. G. W. Adams, for suction-dredge hire, at \$333.33 per day, '85, 1314.
 1886. F. H. Smith, for stone, '87, 1271.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 133; '81, 181, 1177; '82, 176; '83, 187; '84, 195; '85, 206, 207; '86, 204; '87, 164-171.

BOARD OF ENGINEERS.

Convened at New York, February 12, 1881, to report upon project of Capt. Damrell for Pensacola Harbor improvement. Report, '81, 1177. (Cols. Tower and Newton and Lieut. Col. Abbot.)

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1877-'85. Reports, '80, 1067; '81, 1174; '82, 1255; '83, 968; '84, 1161.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1314; '86, 1179; '87, 1269.

ASSISTANT.

H. Haines. Report, '85, 1316, 1322.

Operations.

1879-'80. Removal, under contract, of four wrecks completed, '80, 1067.

1880-'81. No operations, '81, 1174.

1881-'82. Quarters for overseer and workmen completed; mattress sheds and tramways, 4 extra cars, and 2 scows built; 60 linear feet of shore end of jetty built, '82, 1255.

1882-'83. 8,406 cubic yards material dredged from the inner bar; Jetty "A" completed; shore protection north of same partially completed; 400 linear feet of pier built with wharf at extremity; 1,836 tons rock ballast delivered at Fort McRae, '83, 969.

1883-'84. 24,966 cubic yards material dredged from the inner bar; stone protection completed to a length of 220 feet; tramway built and approaches constructed for another shore protection, '84, 1162.

1884-'85. Close piling shore protection replaced; mattress filling raised and whole extended 217 feet; trestle and tramway approach rebuilt, and 80-foot spur built on south side of same; exposed face of work and outer and inner 115 feet of Jetty "A" revetted; 53,369 cubic yards material dredged from outer and inner bars, '85, 1314.

1885-'86. Extensive repairs to shore protection; 55,355 cubic yards material dredged from channel, '86, 1180.

1886-'87. 446 tons stone delivered for jetties; repairs made to plant, '87, 1270.

Projects.

The first project was by Capt. Damrell, 1878, for the removal of four wrecks at the mouth of Pensacola Harbor. Estimated cost, \$20,000. This was completed in 1880, '80, 1067.

PENSACOLA HARBOR, FLA.—Continued.**Projects—Continued.**

By Capt. Damrell, 1879, as modified by Board of Engineers, 1881, for re-establishment of old shore-line, by construction of 4,000 linear feet brush and stone jet-ties in front of Fort McRae and deepening the channel across the inner bar, by dredging to 24 feet depth by 300 feet wide. Estimated cost, \$150,000, '79, 101, 803-810; '81, 1175; '84, 1162; '86, 1180.

Failure of tides to maintain dredged channel. Total amount appropriated from 1878 to 1886, inclusive, \$215,000 Estimated cost of completion of project, \$40,000, '87, 1269.

Surveys.

Of outer and inner bars at entrance to Pensacola Harbor ordered by act of July 5, 1884. Made, 1884, under direction of Capt. Hoxie, '85, 1316.

Of outer and inner bars ordered by act of August 5, 1886, '87, 171.

MAPS.

'81, 1178; '84, 1162.

PENSAUKEE HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 421.)

Appropriations.

1882..... \$10,000, '82, 2129.

1884..... 5,000, '84, 1843.

Contracts.

1883. F. B. Gardner, 1883, for slab-pier construction, '83, 1650.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 270; '83, 278; '84, 278; '85, 301; '86, 295; '87, 261.

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert, 1882-'83. Report, '83, 1651.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1650.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1842; '85, 1985.

Capt. C. E. L. B. Davis, 1886-'— Reports, '86, 1656; '87, 2010.

ASSISTANT.

L. Y. Schermerhorn. Report, '82, 2130.

Operations.

18-'84. 1,300 linear feet of slab-pier built, '84, 1842.

1884-'85. No operations, '85, 1985.

1885-'86. Extensive repairs to slab-pier work, '86, 1656.

1886-'87. No operations, '87, 2011.

Physical Characteristics.

Description of the harbor, '82, 2130.

Projects.

By Lieut. Col. Robert, 1882, for construction of 2,500 linear feet of slab-pier work extending to the 10-foot curve, with dredging, to provide a channel of entrance with an available depth of 10 and a width of 100 feet. Estimated cost, \$50,000, '82, 2132; '83, 1650.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Lieut. Col. Robert, '83, 1651.

PENSAUKEN CREEK, N. J.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 138.

ENGINEER IN CHARGE.

Lieut. Col. G. Weitzel. Report, '84, 852.

ASSISTANT.

E. A. Gieseler. Report, '84, 852.

PENSAUKEN CREEK, N. J.—Continued.**Plans.**

Lient. Col. Weitzel reports, in 1882, that the creek is not worthy of improvement by the General Government and is not a public necessity, '84, 852.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Lient. Col. Weitzel, '84, 852.

PENTWATER HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 422.)

Appropriations.

1867-'79	\$168,820
1880	4,000, '80, 2015.
1881	10,000, '81, 2212.
1882	10,000, '82, 2301.
1884	15,000, '84, 1980.
1886	10,000, '86, 1762.

Total 217,820

1888 8,000, act of August 11, 1888.

Contracts.

1879. Squire & White, for dredging, at 25 cents per cubic yard, and pile-revetment construction, '80, 2015.

1881. Squire & White, for dredging, at 24 cents per cubic yard, '81, 2212. J. Corlett, pier construction, '81, 2212.

1882. Squire & White, for dredging, at 23 cents per cubic yard, '83, 1818. T. H. Smith, for pier extension, '83, 1817.

1887. C. E. Mitchell, for crib-pier construction, '87, 2187.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 215; '81, 292; '82, 287; '83, 294; '84, 296; '85, 318; '86, 312; '87, 20.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80. Report, '80, 214.

Maj. F. Harwood, 1880-'82. Reports, '80, 2014; '81, 2211.

Maj. D. P. Heap, 1882-'83. Report, '82, 2301.

Capt. D. W. Lockwood, 1883-'— Reports, '83, 1817; '84, 1978; '85, 2075; '86, 1762; '87, 2186.

Operations.

1880-'81. 1,528 linear feet catch-sand fence built; piers and revetments repaired; 20,000 cubic yards material dredged, '81, 2211.

1881-'82. 50 linear feet of crib-work sunk in extension of north pier; 19,478 cubic yards material dredged from channel, '82, 2301.

1882-'83. 50 linear feet of superstructure built; repairs to pier-work; dredging under Squire & White's contract continued, '83, 1817.

1883-'84. 12,838 cubic yards material dredged from between the piers; damage to north pier end repaired, '84, 1979, 1980.

1884-'85. 106 linear feet of filling removed and replaced; 150 feet of revetment backing overhauled and repaired; 1 crib sunk in extension of north pier; filling placed in interval between south pier cribs, '85, 2075.

1885-'86. Extensive repairs to north and south piers, '86, 1763.

1886-'87. One 50-foot crib placed on pile foundation in extension of south pier, '87, 2186.

Projects.

By Maj. Wheeler, 1866, for increasing width of the outlet to 150 feet, close-piling the sides of the cut, extension of piers across the bar into Lake Michigan 1,200 feet, and dredging the channel between the piers to a depth of 12 feet, '67, 113; '68, 130.

Original estimate of 1866 amended, 1873, to \$192,020, '78, 1205; '87, 2186.

From 1867 to 1882, inclusive, \$192,820 was appropriated.

In 1884 Capt. Lockwood considered that the completion of the improvement would require the construction of 300 linear feet of pier-work, dredging at entrance and between piers, and repairs. Estimated cost, \$70,000, '84, 1980.

Surveys.**MAPS.**

'82, 2302; '84, 1980.

PERE MARQUETTE LAKE, MICH. (See LUDINGTON HARBOR.)

(Continued from Vol. I, p. 423.)

PERQUIMAN'S RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 424.)

Appropriations.

1876..... \$2,500

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 116; '85, 164.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. Agent, 1875-'80. Report, '80, 790.

Capt. F. A. Hinman. Report, '85, 1045.

ASSISTANT.

G. H. Elliot. Report, '85, 1045.

Operations.

Work of improvement consisting of stump and log removal, etc., completed in 1877, and no further appropriations required, '80, 790.

Plans.

In 1884 Capt. Hinman did not consider the river above Hartford as worthy of improvement from a commercial point of view, '85, 1046.

Surveys.

Examination of river above Hartford ordered by act of July 5, 1884. Made, 1884, under direction of Capt. F. A. Hinman, '85, 1045.

PERTH AMBOY, N. J. (See AMBOY.)**PETALUMA CREEK, CAL.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 424.)

Appropriations.

1880..... \$8,000, '80, 2243.

1881..... 8,000, '81, 2479.

1882..... 14,000, '82, 2539.

• Total 30,000

1888..... 2,000, act of August 11, 1888.

Commerce.

Present improvement, 1883, of great benefit to commerce, '83, 1982.

Service of improvement to commerce, '84, 2199.

Contracts.

1880. E. Hackett, for dredging, at 29 and 45 cents per cubic yard, '81, 2480.

1882. W. Gwynn, for dredging, at 25½ cents per cubic yard, '83, 1983.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 235; '81, 322; '82, 316; '83, 329; '84, 332; '85, 359; '87, 323.

ENGINEERS IN CHARGE.

Lient. Col. G. H. Mendell, 1879-'85. Reports, '80, 2242; '81, 2478; '82, 2539; '83, 1982; '84, 2198; '85, 2339.

Capt. A. H. Payson, 1887-'— Report, '87, 2446.

Operations.

1880-'81. 21,135 cubic yards material dredged from cut-offs and channel, '81, 2478.

1881-'82. No operations, '82, 2539.

1882-'83. 25,290 cubic yards material dredged, '83, 1982.

1883-'84. 43,267 cubic yards material dredged, completing project, '84, 2198.

1884-'85. No operations, '85, 2339; '87, 2446.

PETALUMA CREEK, CAL.—Continued.**Physical Characteristics.**

Description of Petaluma Creek, '80, 2243.

Projects.

By Lieut. Col. Mendell, 1879, for improvement of river below Petaluma by dredging the channel to a depth of 3 feet at low water, and also shortening the existing channel 5,820 feet by a cut 50 feet wide and 3 feet deep at low water. Estimated cost, \$25,868. Total expenditures to completion of work in 1884 was \$27,656, '85, 2339; '87, 2446.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Lieut. Col. Mendell, '80, 2243.

PETER'S NECK BAY, N. Y.—EXAMINATION OF**Commerce.**

Present and prospective, '87, 638.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 55.

ENGINEER IN CHARGE.

Lieut. Col. D. C. Houston, 1886. Report, '87, 637.

Physical Characteristics.

Description, '87, 638.

Plans.

Lieut. Col. Houston, 1886, reports that the present and prospective commerce does not warrant an expenditure for permanent improvement, '87, 639.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Lieut. Col. Houston, '87, 677.

PETIT JEAN RIVER, ARK.—SURVEY AND IMPROVEMENT OF.

(Continued from Vol. I, p. 424.)

Appropriations.

1886..... \$3,500, '87, 1530.

1888..... 2,500, act of August 11, 1888.

Encroachments.

Obstruction to commerce from a bridge at Rocky Crossing, '87, 1530.

Engineers.

CHIEF OF ENGINEERS.

Reports, '85, 252; '87, 206.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1885.—. Reports, '85, 1627; '87, 1529.

ASSISTANT.

M. A. Orlapp. Report, '85, 1628.

Operations.

1886-'87. Removal of obstructions between mouth and Rocky Crossing, '87, 1529.

Physical Characteristics.

Description of river, '85, 1628.

Projects.

By Capt. Taber for improvement of high-water navigation as far as Danville by removal of snags and similar obstructions. Estimated cost, \$6,480, '85, 1630.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Taber, '85, 1627.

PIANKATANK RIVER, VA.—SURVEY OF.**Commerce.**

Statistics of trade, '84, 1016.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1013, 1014.

Plans.

By S. T. Abert, in 1883, for improvement of the river at its mouth by excavation of a channel 200 feet wide and 11 feet deep through the bar, at an estimated cost of \$58,533, or for a channel of same depth and 150 feet width, \$43,900, '84, 1015, 1016.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under direction of S. T. Abert, '84, 1014.

PIER AT LEWES, DEL. (See LEWES, DEL., PIER AT.)

PIGEON RIVER, MICH.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 286.

ENGINEER IN CHARGE.

Capt. D. W. Lockwood. Report, '87, 2207.

Physical Characteristics.

Description, '87, 2207.

Plans.

Capt. Lockwood, 1886, reports the harbor as unworthy of improvement, as any such work would benefit local commerce alone, '87, 2208.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Lockwood, '87, 2207.

PILGRIM ROCK, EAST RIVER, N. Y. (See EAST RIVER, N. Y.)

PINEPOG RIVER, MICH.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 294.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe, 1886. Report, '87, 2274.

Physical Characteristics.

Description of, '87, 2274.

Plans.

Lieut. Col. Poe, 1886, reports the river as unworthy of improvement in view of probable cost of same, '87, 2275.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Poe, '87, 2274.

PINE RIVER, MICH.—EXAMINATION OF.

(Continued from Vol. I, p. 425.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 332.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe. Report, '85, 2183.

ASSISTANT.

O. B. Wheeler. Report, '85, 2184.

Plans.

In 1884 Lieut. Col. Poe did not consider that the commerce of the river justified the improvement, '85, 2183.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. O. M. Poe. Report, '85, 2183.

PISCATAWAY CREEK, MD.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1005.

Plans.

S. T. Abert did not consider the creek worthy of improvement nor the work a public necessity, '84, 1005.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of S. T. Abert, '84, 1005.

PISCATAWAY CREEK, VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1006.

Plans.

In 1883 S. T. Abert did not consider the creek worthy of improvement nor the work a public necessity, '84, 1006.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1883, under direction of S. T. Abert, '84, 1006.

PISCATAQUA RIVER, N. H. AND ME.—SURVEY OF.**Commerce.**

Commercial statistics, '84, 491.

Engineers.**CHIEF OF ENGINEERS.**

Report, '84, 73.

ENGINEER IN CHARGE.

Col. C. E. Blunt. Report, '84, 485, 486.

Physical Characteristics.

Locality described, '84, 486.

Plans.

By Col. Blunt, 1883, for improving the Piscataqua River by a lock and dam just below the mouth of Great Bay, at an estimated cost of \$710,000, '84, 487, 489, 490.

Surveys.

Ordered by act of August 2, 1882. Made under the direction of Col. Blunt, '84, 485, 486.

PLATTSBURGH HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 426.)

Appropriations.

1836-'79	\$140,180.01
1880	1,000.00, '80, 557.
1886	5,000.00, '86, 1902.
1888	7,000.00, act of August 11, 1888.
Appropriations prior to 1880, '80, 557.	

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 89; '81, 113; '82, 114; '83, 324; '84, 327; '85, 355, 357; '86, 348; '87, 314.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 556; '81, 722.

Maj. G. L. Gillespie, 1882-'83. Report, '82, 708.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1956; '84, 2155; '85, 2318.

Maj. M. B. Adams, 1885— . Reports, '85, 2306; '86, 1902; '87, 2405.

ASSISTANTS.

W. P. Judson. Report, '83, 1956.

L. Y. Schermerhorn. Report, '85, 2320.

Operations.

1880-'81. Dredging upon shoals between mouth of river and south wharves, '81, 722.
1881-'85. No operations, '82, 768; '83, 1956; '84, 2155; '85, 2306; '87, 2405.

Plans.

By Lieut. Col. Robert, 1884, for the formation of a dredged basin at the mouth of the Saranac River. Estimated cost, \$60,000, '85, 2319.

Projects.

The earliest appropriation was made in 1836; between this date and 1844, under appropriations aggregating \$57,500, 854 linear feet of breakwater, covering the city wharves, was built, '66, iii, 17; iv, 1881.

Between 1864 and 1869 \$28,000 was expended in repairs, '66, i, 56; '67, 234; '68, 293; '69, 182.

In 1870 additional breakwater extension was undertaken and continued to 1875, during which time the breakwater was extended 400 feet, '71, 254; '72, 271; '73, 393; '74, i, 274; '75, i, 352.

Total appropriations from 1836 to 1886, inclusive, \$146,180.

Surveys.

Of harbor in vicinity of city front and breakwater, '83, 1956.

At mouth of Saranac River, '85, 2318, ordered by act of July 5, 1884. Made under direction of Lieut. Col. Robert, '85, 2318.

MAPS.

'85, 2320; '87, 2405.

PLATTSMOUTH, NEBR. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**PLYMOUTH HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 427.)

Appropriations.

1824-'79	\$122,066.90
1880	10,000.00, '80, 353.
1881	10,000.00, '81, 529.
1882	14,000.00, '82, 523.
1884	10,000.00, '84, 516.
1886	6,000.00, '86, 572.

Total

172,066.90

1888

6,000.00, act of August 11, 1888.

Appropriations prior to 1880, '80, 353.

Contracts.

1880. R. Hamilton, jr., for dredging, at 17 cents per cubic yard, '81, 530.

1881. Eastern Dredging Company, for dredging, at 23 cents per cubic yard, '81, 530.

C. M. Holden, for delivery of loose stone, at \$1.55 per ton, '82, 523.

PLYMOUTH HARBOR, MASS.—Continued.**Contracts—Continued.**

1882. C. W. Edwards, for loose stone, at \$1.70 per ton, '83, 456.

1886. New England Dredging Company, for dredging, at 24 cents per cubic yard, '87, 524.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 70; '81, 75; '82, 76; '83, 70; '84, 76; '85, 64; '86, 64; '87, 30.

ENGINEERS IN CHARGE.

Col. G. Thom, 1874-'83. Reports, '80, 351; '81, 527; '82, 521.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 455; '84, 514; '85, 510, 538.

Lient. Col. G. L. Gillespie, 1886-'—. Reports, '86, 571; '87, 525.

Operations.

1879-'80. 1,693 tons rubble-stone placed in bulkhead work, extending same 700 feet, '80, 352.

1880-'81. 43,950 cubic yards material dredged from the main channel, '81, 527.

1881-'82. 186½ tons bowlders furnished for repair of Long Beach; 44,969 cubic yards material dredged from channel and basin, '82, 522.

1882-'83. 5,006 tons stone placed in bulkhead, extending same 830 feet; 640 linear feet of bulkhead backed with trees and stone; leak north of old crib-work stopped, '83, 455.

1883-'84. Repairs to Long Beach Bulkhead, '84, 515.

1884-'85. 36,426 cubic yards material dredged from channel, '85, 511.

1885-'86. Nine breaches in Long Beach repaired with brush and stone bulkhead work, '86, 573.

1886-'87. 14,812 cubic yards material dredged, '87, 524.

Plans.

By Maj. Raymond, 1884, for excavation of a channel 100 feet wide and 5 feet deep at mean low water, from Goose Point to Cordage Company's Wharf, a distance of 1 mile, at an estimated cost of \$42,000. Maj. Raymond does not, however, consider the harbor worthy of improvement, '85, 538, 539.

Projects.

Prior to 1875 appropriations were applied to the protection and preservation of Long Beach; the aggregate of appropriations from 1824 to 1874, inclusive, was \$103,566.90.

By Lieut. Col. Thom, 1874, for dredging a channel 100 feet wide and 6 feet deep from the "Middle Ground" to Long Wharf at Plymouth, '75, ii, 414. Modified in 1876 to provide for dredging a basin 866 feet long, 150 feet wide, and 8 feet deep, in front of the town wharves, '76, i, 181; '77, 188; '78, 221; '81, 528.

In 1884-'85 it was proposed to widen the channel to 150 feet and deepen to 9 feet, and also deepen the basin to 9 feet, '84, 516; '85, 511.

The amount appropriated from 1875 to 1886, inclusive, was \$68,500, when it was estimated that \$15,500 would be required to complete existing project, '86, 65.

Surveys.

Of channel and basin, 1884, '84, 515.

Of Long Beach, 1886, '86, 572.

Examination of channel from Goose Point, in Plymouth Harbor, to the wharf of the Cordage Company ordered by act of July 5, 1884. Made, 1884, under direction of Maj. Raymond, '85, 538.

MAPS.

'81, 528; '86, 572.

POCOMOKE RIVER, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 429.)

Appropriations.

1878-'79..... \$12,500

1886..... 8,000, '87, 847.

Contracts.

D. W. Constantine, for dredging, at 17½ cents per cubic yard, '80, 645.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 104; '81, 141; '82, 137; '83, 140; '84, 151; '85, 137; '87, 96.

ENGINEERS IN CHARGE.

Lient. Col. W. P. Craighill, 1878-'85. Reports, '80, 644; '81, 889; '82, 859; '83, 6-3; '84, 949.

W. F. Smith, U. S. Agent, 1885-'—. Reports, '85, 904; '87, 847.

POCOMOKE RIVER, MD.—Continued.**Engineers—Continued.****ASSISTANTS.**

J. L. Seager. Report, '84, 949.

T. I. George. Report, '85, 905.

C. M. Bird. Report, '85, 906.

Operations.

1879-'80. Dredging in progress, '80, 645.

1880-'83. No operations; project completed, '81, 889; '82, 859; '83, 683.

Plans.

By W. F. Smith, 1885, for excavation of a cut-off below Snow Hill 80 feet wide and 7 feet deep at mean low water, the length to be 1,100 feet. Estimated cost, \$8,000, '85, 906.

Projects.

By Lieut. Col. Craighill, 1878, for the formation of a dredged channel 7 feet deep, and removal of logs, snags, and obstructions. Estimated cost, \$9,975, '79, 505-510. Project completed in 1880, '81, 889. (See PLANS.)

Surveys.

Examination of Pocomoke River, with a view to a cut-off in the bend just below Snow Hill, not recommended for improvement, '84, 949.

Of Pocomoke River, from Snow Hill to Dighton, 1885, '85, 906.

POINT PLEASANT, W. VA.—EXAMINATION FOR ICE-HARBOR AT.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 195; '81, 263.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '81, 1954.

ASSISTANT.

J. H. Harlow. Report, '81, 1956.

Plans.

By Maj. Merrill, 1881, for formation of harbor of refuge against ice at the mouth of the Great Kanawha River by the construction of four crib-piers filled with stone. Estimated cost, \$22,000, '81, 1955, 1957.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Merrill, '81, 1954.

POND RIVER, KY.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 249.

ENGINEER IN CHARGE.

Maj. J. C. Post. Report, '87, 1901.

Plans.

In 1887 Maj. Post did not consider the river worthy of improvement, '87, 1901.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Maj. Post, '87, 1901.

PORTAGE LAKE AND LAKE SUPERIOR SHIP-CANAL, MICH.**Appropriation.**

1886..... \$10,000, '86, 456.

Commerce.

National importance of route. '87, 1977.

Encroachments.

Injury to harbor at Hancock and Houghton from sand deposits of the stamp mills, '83, 1697, 1698.

PORTAGE LAKE AND LAKE SUPERIOR SHIP-CANAL, MICH.—Continued.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 206; '85, 332, 2170; '87, 257, 1973, 1975.

BOARD OF ENGINEERS.

Constituted by S. O. No. 112, C. of E., 1886, to report upon limiting shore-lines at Portage Lake. Report, '87, 1972. Also upon the expediency of the acquisition of the Portage Lake and Lake Superior Ship-Canal. Report, '87, 1977. (Col. Abbot, Maj. Ernst and Allen.)

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Robert. Reports, '80, 1925; '83, 1696.

Lieut. Col. O. M. Poe. Report, '85, 2170.

Capt. C. E. L. B. Davis. Report, '87, 1971.

ASSISTANTS.

L. Y. Schermerhorn. Reports, '80, 1926; '83, 1698.

G. A. Marr. Report, '87, 1969.

Plans.

By Maj. Robert, 1880, for extension of piers an additional distance of 330 feet, or to a depth of 18 feet, the extension to be parallel to existing piers but with a width increase to 400 feet; the outer ends of present piers to be connected with proposed extension by fender-pilings. Estimated cost, \$74,712, or by changing detail of construction, \$70,994, '80, 1927, 1928.

By Board of Engineers, 1886, for the establishment of limiting shore-lines at Portage Lake, '87, 1972.

Regulations for establishment and maintenance of lines proposed, '87, 1974.

The Board of Engineers of 1886 recommended that the offer of the company to transfer all their rights to the United States for \$350,000 be accepted, and that the route be made a free water-way; also that a navigable depth of 16 feet for a minimum width of 70 feet be obtained, by dredging, throughout the whole extent of the route, '87, 1975, 1976, 1968.

Private and Corporate Work.

Description of its canal and its cost as built by the canal company, '85, 2170; '87, 1789, 1960, 1966.

Present condition of the improvement, '85, 2170; '87, 1962.

Value of the improvement, '86, 2173, 2175; '87, 1965.

Recommended purchase by the United States, '87, 1975, 1976, 1968.

PORTAGE LAKE, MANISTEE CO., MICH.—HARBOR OF REFUGE AT, IMPROVEMENT OF.

(Continued from Vol. I, p. 430.)

Appropriations.

1879.....	\$10,000
1880.....	10,000, '80, 2034.
1881.....	10,000, '81, 2204.
1882.....	25,000, '83, 1813.
1884.....	12,500, '84, 1975.
1886.....	15,000, '86, 1759.

Total 82,500

1888..... 10,000, act of August 11, 1888.

Contracts.

1879. Carkin, Stickney & Cram, for dredging, at 14 cents per cubic yard, '80, 2034.

1886. Truman & Cooper, for dredging, at 12½ cents per cubic yard, '85, 2070.

1887. Schwarz & Burner, for pier extension, '87, 2163.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 219; '81, 290; '82, 285; '83, 293; '84, 294; '85, 316; '86, 310; '87, 278.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1879-'82. Reports, '80, 2032; '81, 2203.

Maj. D. P. Heap, 1882-'83. Report, '82, 2286.

Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1812; '84, 1974; '85, 2069; '86, 1759; '87, 2180.

PORTAGE LAKE, MANISTEE CO., MICH.—Continued.**Operations.**

- 1879-'80. North jetty extended to 236 feet and south jetty to 190 feet in length; 29,992 cubic yards sand dredged, '80, 2032, 2033.
 1880-'81. Both piers extended to 12-foot curve, '81, 2204.
 1881-'82. North pier extended to 815 feet and south pier to 575 feet in length; 62 cords stone filling placed in piers, '82, 2286.
 1882-'83. North pier extended 50 feet; 30,530 cubic yards material dredged from channel; repairs to piers, '83, 1812.
 1883-'84. No operations, '84, 1974.
 1884-'85. North revetment refilled; 10,120 cubic yards material dredged, '85, 2069.
 1885-'86. South revetment completed to 805 feet in length; 555 piles driven, '86, 1758.
 1886-'87. Filling revetment of south pier completed; dredging in channel with United States dredge; extension of north pier in progress, '87, 2180.

Projects.

- By Maj. Mansfield, 1879, for the formation of a channel 300 feet wide and 18 feet deep to connect Lakes Michigan and Portage, the dredged channel to be protected by parallel pile and crib piers extending to the 18-foot curve in Lake Michigan. Estimated cost, \$189,860, '79, 1634, 1636, 1638; '87, 2181.
 Between 1879 and 1882 \$55,000 was appropriated. In 1883 Capt. Lockwood estimated for completion of original project, \$210,000, '84, 1975.

Surveys.**MAPS.**

'82, 2286; '84, 1974.

PORT CHESTER HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 431.)

Appropriations.

1872..... \$12,000
 1882..... 15,000, '80, 669.
 1888..... 5,000, act of August 11, 1888.

Commerce.

Trade and commerce of Port Chester, '84, 712.

Contracts.

1884. R. Parrott, for dredging, at 16 cents per cubic yard, '85, 659.
 1886. M. K. Pidgeon, for furnishing dredge and appliances, at \$83 per day, '86, 652.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 84; '81, 104; '82, 105; '83, 99; '84, 105; '85, 87; '86, 88; '87, 51.

ENGINEERS IN CHARGE.

- Col. J. Newton, 1872-'84. Reports, '80, 514; '81, 647; '82, 668; '83, 548.
 Capt. J. Mercur, 1884-'85. Report, '84, 712.
 Lieut. Col. W. McFarland, 1885-'86. Report, '85, 658.
 Lieut. Col. D. C. Houston, 1886-'— Reports, '86, 651; '87, 620.

Operations.

Operations suspended from 1873 to 1884. ●

- 1884-'85. 55,062 cubic yards material dredged from channel, '85, 659.
 1885-'86. 3,096 cubic yards material dredged from channel, '86, 652.
 1886-'87. 9,232 cubic yards material dredged, '87, 621.

Projects.

- By Lieut. Col. Newton, 1871, for removal of "Sunken Rock" to a depth of 11 feet and "Salt Rock" to a depth of 9 feet; also construction of 400 linear feet of breakwater at Byram Point. Estimated cost, \$96,632, '72, 809; '86, 652.
 Modified in 1884 to provide for dredging a channel 3 feet deep and 60 to 100 feet wide from the bay to the vicinity of the wharves, '84, 712; '86, 88, 652; '87, 621.

Surveys.**MAPS.**

'85, 658.

PORT CLINTON HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 431.)

Appropriations.

1872-'79	\$40,000
1880	5,000, '80, 2102.
1881	5,000, '81, 2291.
1882	6,000, '82, 2389.
1886	2,000, '86, 1855.

Total	58,000
1888	5,000, act of August 11, 1888.

Contracts.

1879. J. Stang, for pier construction, '80, 2103. Cleveland, Brown & Co., for iron, '80, 2104.
 1880. S. A. Sague, for iron, '81, 2291. Salmon & Mares, for pier construction, '81, 2291.
 1881. F. Wilson, for iron, '81, 2292. J. Stang, for pier construction, '81, 2292.
 1882. J. Stang, for pier construction, '82, 1894.
 1887. J. Stang, for repairs to piers and revetments, '87, 2301.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 224; '81, 305; '82, 299; '83, 307; '84, 310; '85, 334; '86, 329; '87, 297.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2099; '81, 2289; '82, 2387.
 Maj. L. C. Overman, 1883-'—. Reports, '83, 1892; '84, 2086; '85, 2215; '86, 1854; '87, 2290.

Operations.

History of work, '80, 2099.

1879-'80. Pile-work completed upon 300 linear feet of west pier and 320 feet of the east revetment, '80, 2102.

1880-'81. West pier extended 450 feet and east pier 904 feet, '81, 2289, 2290.

1881-'82. West pier extended 260 linear feet and 210 feet added to east pier, '82, 2388.

1882-'83. 195 piles driven, forming 4,934 linear feet of pier foundation, '83, 1893.

1883-'84. West pier extended 150 feet and old portions of west pier and east revetment repaired, '84, 2087.

1884-'86. No operations for lack of funds, '85, 2215; '86, 1854.

1886-'87. Repairs to pier-work commenced, '87, 2300.

Projects.

By Maj. McFarland, 1871, for deepening, by dredging, the entrance to Portage River to a depth of 8 feet and for the protection of the channel by two parallel piers. Estimated cost, \$120,000, '71, 210; '80, 2100.

The efforts of 1872-'73 to maintain a channel by dredging having failed, in 1875, Lieut. Col. Blunt proposed a pile revetment from the north shore, and parallel and 200 feet distant an east pile-pier, extending to the 10-foot curve in the lake, '75, i, 295, 296; '80, 2100; '81, 2290.

From 1872 to 1886, inclusive, \$58,000 was appropriated, when it was estimated that \$41,000 would be required to complete the project, '86, 330.

Surveys.

Of harbor, 1882, '82, 2388.

Examination of harbor, 1884, '84, 2088.

MAPS.

'81, 2290.

PORT DAY, NIAGARA RIVER, N. Y.—EXAMINATION OF.**Commerce.**

Benefit of the improvement; '81, 2456.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 233; '81, 320.

ENGINEER IN CHARGE.

Maj. W. McFarland. Report, '81, 2454.

ASSISTANT.

F. T. Hampton. Report, '81, 2455.

PORT DAY, NIAGARA RIVER, N. Y.—Continued.**Plans.**

By Maj. McFarland, for an inside channel at Port Day, by rock removal, 600 feet long and 75 feet wide, with a depth of 6 feet. Estimated cost, \$17,000, '81, 2454.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Maj. McFarland, '81, 2454.

PORT HENRY, LAKE CHAMPLAIN, N. Y.—EXAMINATION OF.

(Continued from Vol. I, p. 433.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 115; '84, 330.

ENGINEERS IN CHARGE.

Maj. G. A. Gillespie. Report, '82, 715.

Lieut. Col. W. McFarland. Report, '84, 2168.

ASSISTANT.

J. A. Gillespie. Report, '84, 2169.

Physical Characteristics.

Description of locality, '82, 715.

Plans.

In 1881 Maj. Gillespie refers to previous survey, 1875, and to the plan for a break-water to give protection from north and west winds. Estimated cost, \$559,030, '76, 1, 261; '82, 717.

In 1883 Lieut. Col. McFarland considered that although the locality was worthy of improvement the work was not a public necessity, '84, 2168.

Surveys.

Examination ordered by acts of March 3, 1881, and August 2, 1882. Made under direction of Maj. Gillespie and McFarland, '82, 715; '84, 2168.

PORT JEFFERSON HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 433.)

Appropriations.

1852-'79	\$65,200
1880	3,000, '80, 468.
1881	4,000, '81, 612.
1882	8,000, '82, 625.

Total 80,200

Statement of appropriations, '81, 612; '87, 633.

Contracts.

1879. J. M. Seward, for dredging, at 55 cents per cubic yard, '80, 469.

1880. J. Scully, for riprap granite, at \$1.69 per ton, '81, 613.

1881. C. F. Stoll, for riprap granite, at \$2.10 per ton, '82, 626.

1883. J. Beattie, for riprap stone, at \$1.54 per ton, '83, 527.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 80; '81, 96; '82, 96; '83, 92; '84, 98; '85, 90; '86, 90; '87, 54.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 467; '81, 611; '82, 624.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 526; '84, 656; '85, 665.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 660; '87, 632.

Operations.

1879-'80. 5,421 cubic yards material dredged from the channel, '80, 468.

1880-'81. 2,579 cubic yards dredged from channel, and 1,400 tons granite placed in the jetties, '81, 611.

1881-'82. 2,120 tons granite placed in east jetty, '82, 625.

1882-'83. 3,413 tons granite riprap placed in 150 linear feet of jetty extension, '83, 526.

FORT JEFFERSON HARBOR, N. Y.—Continued.**Operations—Continued.**

1883-'84. 575 tons granite riprap added to jetty extending same 35 feet, '84, 657.
 1884-'87. No operations, '85, 665; '86, 660; '87, 633.

Projects.

By Maj. Warren, 1871, for the formation of a dredged channel of entrance 200 feet wide and 7 feet deep, protected by a breakwater 800 feet long, '71, 86, 804, 808. Modified in 1875 by the addition of an east jetty, '75, i, 105; ii, 265.
 By Maj. Barlow, 1877, for completion of improvement by extension of jetties to 9-foot curve and excavation of channel between them to 8 feet low water. Estimated cost, \$34,000, '78, 407; '79, 359; '80, 468.

Surveys.**MAPS.**

'82, 626; '84, 656; '86, 660.

PORTLAND HARBOR, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 434.)

Appropriations.

1836-'75	\$351,477.05.
1881	20,000.00, '81, 488.
1882	35,000.00, '82, 498.
1884	30,000.00, '84, 468.
1886	30,000.00, '86, 540.
Total	466,477.05
1888	40,000.00, act of August 11, 1888.

Commerce.

Statistics, '86, 542.

Contracts.

1880. G. C. Forbes, for dredging, at 15½ cents per cubic yard, '81, 488.
 1881. G. C. Forbes, for dredging, at 17 cents per cubic yard, '81, 488.
 1882. Moore & Wright, for dredging, at 13 cents per cubic yard, '83, 422.
 1884. Moore & Wright, for dredging, at 14 cents per cubic yard, '85, 470.
 1887. National Dredging Company, for dredging, at 13 cents per cubic yard, '87, 450.
 450. A. D. Smith, for boat-house construction, at \$400, '87, 450.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 66; '81, 68; '82, 67; '83, 62; '84, 70; '85, 58; '86, 57; '87, 17

ENGINEERS IN CHARGE.

Col. G. Thom, 1866-'83. Reports, '80, 335; '81, 486; '82, 498.
 Col. C. E. Blunt, 1883-'86. Reports, '83, 421; '84, 467; '85, 469.
 Maj. J. A. Smith, 1886-'—. Reports, '86, 538, 541; '87, 448.

Operations.

History of operations prior to 1879, '89, 255.

1880-'81. 67,756 cubic yards material dredged from the harbor, '81, 487.
 1881-'82. 249,468 cubic yards material dredged from the harbor, '82, 498.
 1882-'83. 170,347 cubic yards material dredged from the harbor, '83, 421.
 1883-'84. 69,063 cubic yards material dredged from the harbor, '84, 467.
 1884-'85. 124,603 cubic yards material dredged from the middle ground, '85, 469.
 1885-'86. 19,490 cubic yards material dredged from the harbor, '86, 539.
 1886-'87. 28,000 cubic yards material dredged from the channel, '87, 449.

Projects.

The appropriations of 1836, 1837, and 1838, aggregating \$61,330, were applied towards the partial construction of 1,763 linear feet of breakwater on Stanford's Ledge, '78, 199; '79, 255.

From 1866 to 1884, inclusive, \$375,111.05 was appropriated and applied to the completion of the breakwater to a length of 2,005 feet, the deepening of the lower harbor, by dredging, to 21 feet, and to 16 feet as far up as Brown's Wharf, and a small channel in the Back Cove to a depth of 8 feet, '79, 258; '86, 57, 538; '87, 451.

In 1886 Maj. Smith proposed increasing, by dredging, the channel approaching the lower wharves to a width of 500 feet and a depth of 29 feet, at an estimated cost of \$135,000, '86, 540; '87, 449; also, for continuing the previous improvement in Back Bay so that it shall have a depth of not less than 12 feet at mean low water and a width of 300 feet, following the harbor commissioners' line along that part of the city front for a distance of 5,600 feet. Estimated cost, \$181,000, '86, 542, 543; '87, 452.

PORTLAND HARBOR, ME.—Continued.**Surveys.**

Resurvey of harbor, 1880, '80, 336.

MAPS.

'80, 336; '86, 542; '87, 450.

PORTLAND, ME.—IMPROVEMENT OF CHANNEL IN BACK COVE.**Appropriations.**

1886..... \$26,250, '87, 453.

1888..... 25,000, act of August 11, 1888.

Contracts.

1887. J. E. Chapman, for dredging, at 16 cents per cubic yard, '87, 453.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 18.

ENGINEER IN CHARGE.

Maj. J. A. Smith. Reports, '86, 541; '87, 451.

Operations.

Survey of channel and preparations for dredging, '87, 452.

Projects.

By Maj. Smith, 1886, for widening and deepening the channel in Back Cove so as to afford a channel 300 feet wide and 12 feet deep at mean low water for a distance of about 5,600 feet along the harbor commissioners' line. Estimated cost, \$181,000, '86, 542; '87, 452.

Surveys.

Of channel in Back Cove, '87, 452.

PORT MARSHALL HARBOR, N. Y.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 330.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland Report, '84, 2161.

ASSISTANT.

J. A. Gillespie. Report, '84, 2161.

Plans.

In 1883 Lieut. Col. McFarland did not consider the harbor a public necessity nor the work as worthy of improvement, '84, 2161.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1883, under direction of Lieut. Col. McFarland, '84, 2161.

PORT ONTARIO HARBOR, N. Y. (See SALMON RIVER, N. Y.)**PORT PENN, DEL. (See ICE-HARBOR AT REEDY ISLAND.)****PORT ROYAL RIVER, S. C.—SURVEY OF.**

(Continued from Vol. I, p. 438.)

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 132.

1443 EN—27

PORT ROYAL RIVER, S. C.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Lieut. Col. Q. A. Gillmore. Report, '80, 1032.

ASSISTANT.

G. Daubeney. Report, '80, 1034.

Plans.

By Lieut. Col. Gillmore, 1880:

I. For improvement of channel, by dredging, at Beaufort and at Fort Charlotte, so that a draught of 14 feet can be carried from Port Royal Sound to Beaufort, \$9,900.

II. For improving only channel at Fort Charlotte to 200 feet width and 14 feet depth, \$5,100.

III. For improvement of channel at Fort Charlotte to 200 feet width and 13 feet depth, \$1,800, '80, 1033, 1034.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Gillmore, '80, 1032.

PORTSMOUTH HARBOR, N. H.—IMPROVEMENT OF, AT PORTSMOUTH.

(See also **LITTLE HARBOR, N. H.**)

(Continued from Vol. I, p. 438.)

Appropriations.

1821-'79	\$10,000
1880	25,000, '80, 341.
1881	20,000, '81, 500.
1882	17,000, '82, 508.
1884	20,000, '84, 470.
1886	15,000, '86, 548.

Total..... 107,000

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '87, 463.

Contracts.

1879. H. Hamilton, for rubble-stone, at 69 cents per ton, '80, 342.

1880. J. F. Curritt, for rubble-stone, at 77 cents per ton, '81, 501.

1882. J. Andrews, for rock removal, at \$18 per cubic yard, '82, 508. S. S. Andrews, for rock removal, at \$34.50 per cubic yard, '83, 432.

1884. G. W. Townsend, for rock removal, at \$22 per cubic yard, '85, 474.

1886. G. W. Townsend, for rock removal, at \$18.97 per cubic yard, '87, 465.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 68; '81, 71; '82, 71; '83, 65; '84, 71, 73; '85, 58, 60; '86, 58; '87, 20.

ENGINEERS IN CHARGE.

Col. G. Thom, 1873-'83. Reports, '80, 340; '81, 498; '82, 505; '84, 474.

Col. C. E. Blunt, 1883-'86. Reports, '83, 430; '84, 469; '85, 472, 478, 484.

Maj. J. A. Smith, 1886-'— . Reports, '86, 546; '87, 463.

Operations.

1879-'80. 12,200 tons stone placed in the work, '80, 341.

1880-'81. 2,400 tons stone placed in the jetty; 100 cubic yards rock removed from channel, '81, 500.

1881-'82. 310 cubic yards rock removed from ledges, '82, 506, 507.

1882-'83. 690 cubic yards solid rock removed from ledges, '83, 431.

1883-'84. 500 cubic yards rock removed from Gangway Rock; 300 cubic yards material dredged, '84, 470.

1884-'85. 400 cubic yards rock removed, '85, 473.

1885-'86. 803 cubic yards rock removed, '86, 547.

1886-'87. 100 cubic yards rock removed, '87, 464.

Projects.

By Lieut. Thom, 1879, for improvement of Portsmouth Harbor by construction of a breakwater 820 feet in length between Great and Goat islands; also for removal of Gangway Rock to a depth of 20 feet, and of a part of the ledge off Badger's Rock to a depth of 10 feet at mean low water, at a total estimated cost of \$150,000, '79, 48, 261, 282.

In 1882 Col. Thom did not consider the completion of the proposed breakwater a public necessity, '84, 474.

PORTSMOUTH HARBOR, N. H.—Continued.**Surveys.**

Of sunken ledges at point of Goat Island, near Portsmouth Pier, and also in harbor of refuge at Jersey Point, 1882, '82, 507.

Examination of harbor at Portsmouth from sea to the wharf ordered by act of July 5, 1884. Made, 1885, under direction of Col. Blunt, '85, 478; not recommended for improvement.

Examination of Little Harbor, at Portsmouth, with view to its improvement as a harbor of refuge, ordered by act of July 5, 1884. Made, 1885, under direction of Col. Blunt, '85, 460.

Examination for extension and completion of the breakwater near third bridge in Portsmouth Harbor. Made, 1882, under direction of Col. Thom, '84, 474.

MAPS.

'86, 546.

PORTSMOUTH, NEBR. (See MISSOURI RIVER FROM MOUTH TO SIOUX CITY.)**PORT TOBACCO CREEK, MD.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, J. S. Agent. Report, '84, 163.

Plans.

In 1882 S. T. Abert reports the creek as worthy of improvement but that the work is not a public necessity, '84, 1009.

Surveys.

Examination ordered by act of August 2, 1882. - Made, 1882, under direction of S. T. Abert, '84, 1008.

PORT WASHINGTON HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 439.)

Appropriations.

1870-79	\$100,500
1880	20,000, '80, 1923.
1881	17,000, '81, 2110.
1882	17,000, '82, 2152.
1884	10,000, '84, 1859.
1886	5,000, '86, 1673.

Total..... 169,500

1888..... 5,000, act of August 11, 1888.

Appropriations prior to 1880, '86, 1673.

Contracts.

1880. Knapp & Gillen, for pier extension, '80, 1923. Truman & Cooper, for pier extension, '81, 2111.

1881. Truman & Cooper, for pier extension, '81, 2111.

1882. Truman & Cooper, for superstructure construction, '83, 1695.

1883. Rand & Burger, for dredge hull and scows, '83, 1695.

1884. Truman & Cooper, for pier extension, '85, 2004.

1886. Truman & Cooper, for pier extension and superstructure construction, '87, 2052.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 206; '81, 278; '82, 274; '83, 283; '84, 283; '85, 306; '86, 300; '87, 265.

PORT WASHINGTON HARBOR, WIS. —Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. H. M. Robert, 1875-'83. Reports, '80, 1922; '81, 2109; '82, 2151.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1693.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1858; '85, 2003.

Capt. C. E. L. B. Davis, 1886-'— . Reports, '86, 1672; '87, 2050.

Operations.

1879-'80. 3,410 cubic yards sand dredged from between the piers; 2 cribs built and sunk in extension of the north pier; south pier superstructure partially refilled; breach in south embankment of west basin repaired by city of Port Washington, '80, 1922.

1880-'81. Six cribs built and three sunk in extension of north pier, '81, 2109.

1881-'82. Eleven cribs built and sunk, 4 in extension of north and 7 in extension of south pier; 49,063 cubic yards material dredged from north basin and from channel; 86 piles removed from basin entrance, '82, 2151.

1882-'83. One crib sunk in south pier extension; partial superstructure built over 14 crib substructures, '83, 1693.

1883-'84. No operations, '84, 1858.

1884-'85. 350 linear feet north and 250 linear feet south pier superstructure completed; 16,513 cubic yards material dredged from the channel, '85, 2003.

1885-'86. 27,194 cubic yards material dredged from harbor; 3 outer cribs of north and south piers protected with 74 cords of riprap, '86, 1672.

1886-'87. One 50-foot crib sunk in extension of the north pier, '87, 2051.

Physical Characteristics.

Description of river and its obstructions, '80, 1032.

Projects.

By Maj. Wheeler, 1869, for two parallel crib-piers 200 feet apart, extending to 14 feet in the lake, with the dredging of a channel between the piers 12 feet deep and the excavation and revetment of a (west) river basin. Estimated cost, \$154,527, '70, 119; '76, ii, 381. Modified in 1870 by changing direction of piers and reducing the width between them to 150 feet, '73, 207; '76, ii, 380. Again modified in 1876 to provide for the excavation of a basin on the north side of the channel 700 by 200 feet and 12 feet deep, '76, ii, 380; '77, 866.

Total estimated cost of project of 1869, with modifications of 1870 and 1876, \$181,500, '77, 866; '83, 1693; '87, 2050.

Surveys.**MAPS.**

'81, 2110.

POTOMAC RIVER—FISH-WAYS AT GREAT FALLS OF, CONSTRUCTION OF.**Appropriations.**

1882..... \$50,000, '83, 2092; '87, 2565.

Contracts.

J. E. Lyons, for fish-way construction, '85, \$2,500.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 339; '84, 344; '85, 374; '86, 368; '87, 335.

ENGINEER IN CHARGE.

Maj. G. J. Lydecker, 1883-'—. Reports, '83, 2092; '84, 2311, '85, 2499; '86, 2061; '87, 2564.

ASSISTANT.

Capt. T. W. Symons. Reports, '84, 2312; '85, 2500.

Operations.

1885-'86. Work upon fish-ways commenced under contract, but abandoned after destruction of unfinished portion by flood, '86, 2061.

1886-'87. Reconstruction of dam, '87, 2564.

Projects.

By Maj. Lydecker, 1883, for erection of fish-ways at Great Falls of the Potomac River. Estimated cost, \$34,160, '85, 2499; '87, 2565.

Surveys.**MAPS.**

'84, 2321, 2336.

POTOMAC RIVER IN VICINITY OF WASHINGTON, D. C.— IMPROVEMENT OF.

(Continued from Vol. I, pp. 441, 572.)

Appropriations.

1833-79	\$351,500
1880. Washington and Georgetown harbors.....	40,000, '80, 751.
1881. Washington and Georgetown harbors.....	50,000, '81, 944.
1882. Potomac River	400,000, '83, 794.
1884. Potomac River	500,000, '84, 978.
1886. Potomac River	375,000, '86, 887.

Total	1,716,500
-------------	-----------

1888.....	300,000, act of August 11, 1888.
-----------	----------------------------------

Statement of appropriations, '80, 751; '87, 884.

Contracts.**WASHINGTON AND GEORGETOWN HARBORS:**

1879. C. G. Fobes & Co., for dredging, at 40 cents per cubic yard, '80, 747.
 1880. National Dredging Company, for dredging, at 14 cents per cubic yard, '81, 939. Contract annulled, '81, 940.
 1881. National Dredging Company, for dredging, at 24 cents per cubic yard, '82, 972.
 1882. Potomac Dredging Company, for dredging, at 28 cents per cubic yard, '82, 975.
 1883. American Dredging Company, for rock removal, '83, 768.
 1884. American Dredging Company, for rock removal, '84, 968. E. R. Lowe, for rock removal, '85, 924.

POTOMAC RIVER:

1882. P. S. Ross, for dredging, at 21 cents per cubic yard, '83, 786.
 1883. T. P. Morgan, for dredging trench, at 7 cents per cubic yard for foundation and 14 cents for ridge, '83, 789. H. P. Gilbert, for riprap stone, at 74½ cents per cubic yard, '83, 789. S. T. Thomas and J. A. Blundon, for brush, at \$2.50 per cord, respectively, '83, 790. J. T. Summers, for flat-boat construction, '83, 790. F. C. Somers, for dredging along slope wall of Potomac Flats and deposit of material behind same, at 11 cents per cubic yard, '84, 974. J. Taylor, for filling, at 24 cents per cubic yard, '84, 974. Contract closed before completion, '84, 974. T. P. Morgan, for filling, at 21 cents per cubic yard, '84, 975.
 1884. Potomac Red Sandstone Company, for riprap, at 87 cents per cubic yard, '84, 975. Benson & McNee, for dredging, at 12.37 cents per cubic yard, '85, 928. D. E. Culver, for dredging and embankment foundation, at 11½ cents per cubic yard, '85, 930. F. C. Somers, for dredging and embankment foundation, at 10½ cents per cubic yard, '85, 930.
 1885. G. Vanderwerken, for riprap, at 85 cents per cubic yard, '85, 934. Benson & McNee, for dredging, at 15 cents per cubic yard, '85, 934.
 1886. F. C. Somers, for dredging, at 10½ cents per cubic yard, '87, 890. G. Vanderwerken, for riprap stone, at 83 cents per cubic yard, '87, 891. Benson & McNee, for dredging, at 15 cents per cubic yard, '87, 891. H. Wilson, for dredging, at 10 cents per cubic yard, '87, 892. R. Moore, for dredging, at 13 cents per cubic yard, '87, 893.
 1887. T. W. Smith, for lumber; American Improved Cement Company, for cement; J. Miller, for sand and pebbles; Atcheson Brothers, for iron, '87, 895. Nolan & Son, for masonry construction, '87, 897.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 111, 158; '81, 150, 154; '82, 145, 150, 980; '83, 149, 150; '84, 151, 152; '85, 139, 140, 938; '86, 135, 136; '87, 102.

BOARD OF ENGINEERS.

Convened February 18, 1882, by S. O. No. 129, C. of E., to report upon improvement of Potomac River at Washington, the raising of the flats in front of the city, and the establishment of harbor lines. Report, '82, 987. (Lieut. Cols. Gillmore, Craighill, and Comstock and Capt. Turtle.)

Reconvened at New York, October 13, 1884, by S. O. No. 124, to report upon proposed modification of plan of improvement as submitted by Maj. Hains, '85, 941. (Col. Gillmore and Lieut. Cols. Comstock and Craighill.)

ENGINEERS IN CHARGE.

S. T. Abert, U. S. Agent, 1875-'83. Reports, '80, 745; '81, 937; '82, 969, 980. Maj. P. C. Hains, 1883-'—. Reports, '83, 763, 770; '84, 965, 970; '85, 923, 926; '86, 879, 881; '87, 884.

Operations.**WASHINGTON AND GEORGETOWN HARBORS:**

History of work, '80, 745.

POTOMAC RIVER IN VICINITY OF WASHINGTON, D. C.— Continued.

Operations—Continued.

- 1879-'80. Washington Channel, 90,744 cubic yards material dredged; Georgetown Channel, 159,979 cubic yards material dredged, '80, 747, 748.
 1880-'81. No operations, '81, 939, 940.
 1881-'82. Washington Channel, 240,111 cubic yards material dredged; Georgetown Channel, dredging under contract of 1882 commenced.
 1882-'83. No operations, '83, 766.
 1883-'84. 490 cubic yards rock blasted and removed, '84, 969.
 1884-'85. Removal of rocks designated as "K" and "O" completed, '85, 924.
 1885-'86. Rock groups designated as "L," "M," "N," "F," and "C" removed, '86, 879, 880.
 1886-'87. No operations, '87, 883.

POTOMAC RIVER:

History of work, '83, 770.

- 1882-'83. 200,000 cubic yards material dredged and deposited upon the flats; 13,000 linear feet railroad built, equipped, and put into operation; 5,000 linear feet of trench completed; construction and placing of mattress commenced by hired labor, '83, 787-791.
 1883-'84. 1,136,531 cubic yards material dredged and deposited upon flats; 8,000 linear feet slope revetment foundation laid; 100,945 cubic yards material dredged and deposited in embankment; 6 acres of the flats filled; 763 cubic yards stone deposited in slope wall, '84, 153, 970-975.
 1884-'85. 1,207,000 cubic yards material excavated under all the dredging contracts, '85, 140, 922-934.
 1885-'86. 1,686,183 cubic yards material dredged and deposited on the flats, '86, 136, 882.
 1886-'87. Progress on construction of reservoir outlet and embankment; 1,081,567 cubic yards material dredged and deposited on the flats, '87, 886, 887.

Physical Characteristics.

Flood of February, '81, 940.

Cross-sections of Potomac River between Aqueduct Bridge and Arsenal Wharf, '82, 982.

Cross-sections of Potomac River between Aqueduct Bridge and Arsenal Wharf, '82, 982.

Velocity observations, '82, 983.

Potomac River front, '82, 992.

Description of river, '83, 781. Long Bridge, '83, 783. Sewer canal, '83, 791. Lakes, '83, 792. Sluice-gates, '83, 793.

Plans.

Description of these considered by Board of Engineers of 1882, '82, 968, 995, 996.

Projects.

WASHINGTON AND GEORGETOWN HARBORS:

In 1833 an appropriation of \$150,000 was made for the removal of obstructions in Potomac River, the purchase of Little Falls Bridge, and the construction of a turnpike road, '79, 591.

In 1870 it was proposed to secure a depth of 16 feet at low water to Georgetown and along the wharves of the Washington Harbor from Arsenal Point to Long Bridge, and the removal of the most dangerous obstructions in Georgetown Harbor, '70, 534; '71, 592, 595; '83, 776; '86, 135.

In 1882 this improvement was merged in that of the improvement of the Potomac River at Washington, '82, 990, 992.

POTOMAC RIVER:

In 1882 a Board of Engineers recommended the widening and deepening of the channels between Giesborough Point and Easby's Point, so as to accommodate the largest vessels that can reach the former locality; the reclamation of the flats and marshes along the city front, between Easby's Point and the arsenal, by depositing thereon material dredged from the channels; the establishment of harbor lines beyond which wharves shall not be built; the removal or rebuilding of Long Bridge; the interception of sewage now discharged into the navigation channel, and its conveyance to James Creek. Estimated cost, \$2,500,000, '82, 990; '83, 740.

In 1883 the estimate was increased to \$2,716,365, '83, 794.

In 1885 Maj. Hains proposed a modification of height of filling over reclaimed areas below Long Bridge, and the omission of the surrounding levee and drainage system; also the construction of a tidal reservoir for flushing the canal sewer, '85, 939.

Approved by Board of Engineers, 1885, '85, 942.

POTOMAC RIVER IN VICINITY OF WASHINGTON, D. C.— Continued.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of S. T. Abert, '82, 980.

Of Virginia Canal, 1882, '82, 974.

Of Potomac River between Aqueduct Bridge and Giesborough Point, 1882, '82, 980.

Examinations and borings for site of sluice-gates, '86, 835.

MAPS.

'80, 750; '81, 944; '83, 794; '84, 978; '85, 938; '86, 886; '87, 890.

POTOMAC RIVER at Mount Vernon—IMPROVEMENT OF.

(Continued from Vol. I, p. 350.)

Appropriations.

1879.....	\$4,000
1880.....	3,000, '80, 753.
1881.....	1,500, '81, 946.
1888.....	6,000, act of August 11, 1888.

Commerce.

Justification of improvement, '86, 900.

Contracts.

1879. G. H. Ferris, for dredging, at 17 cents per cubic yard, '80, 752.

1881. National Dredging Company, for dredging, at 12½ cents per cubic yard, '81, 946.

1882. National Dredging Company, for dredging, at 15½ cents per cubic yard, '82, 1005.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 112; '81, 151; '82, 146; '83, 152; '84, 154; '85, 144; '86, 139; '87, 106.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1879— Reports, '80, 752; '81, 945; '82, 1003; '83, 795; '84, 980; '85, 962; '86, 899; '87, 927.

Operations.

History of operations, '85, 962.

1879-'80. 20,379 cubic yards dredged from channel and basin, '80, 753.

1880-'81. 21,005 cubic yards dredged, '81, 946.

1881-'82. 8,118 cubic yards dredged, '82, 1005. Channel 145 feet wide and from 7 to 9 feet deep completed, '83, 795.

1882-'86. No operations, '83, 795; '84, 980; '85, 962; '86, 900.

Projects.

By S. T. Abert, 1879, for the formation of a dredged channel from deep water in the Potomac to the wharf at Mount Vernon 150 feet wide and 7 feet deep, with a suitable turning-basin at the wharf, at an estimated cost of \$14,000, '79, 598, 599; '86, 139.

Necessity for further deepening in 1886, '86, 139.

POTOWOMUT RIVER, R. I.—IMPROVEMENT OF.

Appropriations.

1881..... \$5,000, '81, 560.

Contracts.

1881. S. A. Hammond, for dredging, at 23 cents per cubic yard, '81, 559.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 76; '81, 84, 89; '82, 84.

ENGINEER IN CHARGE.

Lieut. Col. G. K. Warren, 1880-'82. Reports, '81, 559, 560; '82, 560.

ASSISTANT.

H. A. Bentley. Report, '81, 560.

Operations.

1881-'82. 15,012 cubic yards material dredged from bar at river mouth, 63 tons of rock removed from Euston's Rocks, completing the improvement as projected, '82, 560.

POTOWOMUT RIVER, R. I.—Continued.**Physical Characteristics.**

Description of river and locality, '81, 560.

Projects.

By Col. Warren, for improving mouth of Potowomut River by excavation of a channel 2,500 feet long, 150 feet wide, and 5 feet deep at mean low water; also removal of Euston's Rocks. Estimated cost, \$5,587.50, '81, 562; '82, 560.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Warren, '81, 560.

POWELL RIVER, VA. AND TENN.—EXAMINATION OF.

(Continued from Vol. I, p. 442.)

Commerce.

Losses occasioned by insufficient channel-ways, '81, 1887.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 190; '81, 258.

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '81, 1886.

ASSISTANT.

W. G. Sanborn. Report, '81, 1887.

Physical Characteristics.

Description of river and obstructions, '81, 1887.

Plans.

By Maj. King, 1881, for improvement of Powell River by dredging, rock removal, and removal of snags and drift, and construction of 4,000 cubic yards of wing-dams. Estimated cost, \$35,580, '81, 1887.

Surveys.

Ordered by act of June 14, 1881. Made, 1881, under direction of Maj. King, '81, 1886.

POWOW RIVER, MASS.—SURVEY OF.

[\$3,000 appropriated by act of August 11, 1888.]

Commerce.

Justification of improvement, '85, 550.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 67.

ENGINEER IN CHARGE.

Maj. C. W. Raymond. Report, '85, 549.

ASSISTANT.

S. Haagenzen. Report, '85, 551.

Physical Characteristics.

Description of river, '85, 549, 552.

Plans.

By Maj. Raymond, 1885, for the formation of a dredged channel 12 feet deep at low water between Amesbury and the mouth, a distance of 1½ miles, at an estimated cost of \$77,000, '85, 551.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Maj. Raymond, '85, 549.

PROVIDENCE RIVER, R. I.—REMOVAL OF GREEN JACKET SHOAL AT PROVIDENCE.**Appropriations.**

1886..... \$26,250, '86, 603.

1888..... 28,000, act of August 11, 1888.

Contracts.

W. H. Beard, for dredging, at 10½ cents per cubic yard, '87, 554.

PROVIDENCE RIVER, R. I.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports '85, 73; '86, 75; '87, 38.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Elliot, 1885-'87. Reports, '85, 601; '86, 605.

Maj. W. R. Livermore, 1887-'— . Report, '87, 553.

Operations.

1886-'87. Preparations for removal of shoal, '87, 553.

Physical Characteristics.

Description of shoal, '85, 601.

Projects.

By Lieut. Col. Elliot, 1885, for the removal, by dredging, of Green Jacket Shoal in the harbor of Providence to a depth of 25 feet at mean low water. Estimated cost, \$112,346, '85, 602; '86, 75, 605; '87, 553.

Surveys.

Of 1884 of Green Jacket Shoal, '85, 597.

MAPS.

Of Providence Harbor, '85, 599.

PROVIDENCE RIVER AND NARRAGANSETT BAY, R. I.—IMPROVEMENT OF.

(Continued from Vol. I, p. 443.)

Appropriations.

1852-'79	\$174,000
1880, Providence River and Narragansett Bay .	60,000, '80, 386.
1881, Providence River and Narragansett Bay .	60,000, '81, 559.
1882, Providence River and Narragansett Bay .	125,000, '82, 457.
1884, Providence River and Narragansett Bay .	85,000, '84, 620.
1886, Providence River and Narragansett Bay .	30,000, '86, 603.
Total	534,000
1888	40,000, act of August 11, 1888.

Contracts.

1879. Atlantic Dredging Company, for dredging, at 16 cents per cubic yard, '80 385. I. A. Sylvester, for rock removal, '80, 385.

1880. Atlantic Dredging Company, for dredging, at 16½ cents per cubic yard, '81, 557.

1881. Atlantic Dredging Company, for dredging, at 17 and 19 cents per cubic yard, '81, 558.

1882. Atlantic Dredging Company, for dredging, at 16 cents per cubic yard, '83, 484.

1884. Atlantic Dredging Company, for dredging, at 12 cents per cubic yard, '85, 598.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 74; '81, 82; '82, 82; '83, 79; '84, 85; '85, 73; '86, 74; '87, 37.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1875-'82. Reports, '80, 383; '81, 557; '82, 555, 557.

Maj. J. W. Barlow, 1882, '83, 483.

Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 483; '84, 617; '85, 598; '86, 602.

Maj. W. R. Livermore, 1887-'— . Report, '87, 550.

ASSISTANT.

H. A. Bentley. Report, '80, 387.

Operations.

History of improvement previous to 1878, '80, 383.

1879-'80. 327,559 cubic yards material dredged from channel through Pawtuxet Shoal; removal of Bulkhead Rock commenced, '80, 385, 386.

1880-'81. 483,768 cubic yards material dredged from Pawtuxet Shoal; 794 tons rock blasted and removed from Bulkhead Rock, '81, 557, 558.

1881-'82. 322,255 cubic yards material dredged, '82, 556.

1882-'83. 502,304 cubic yards material dredged from Gaspee, Sassafras, and Fox Point channels, '83, 484.

1883-'84. 217,724 cubic yards of material dredged, '84, 619.

1884-'85. 625,073 cubic yards material dredged from channel below Field's Point; also obstructions at mouth of the Pawtuxet River removed, '85, 598.

1885-'86. No operations for lack of funds, '86, 603.

1886-'87. 111,372 cubic yards material dredged from channel and anchorage basins, '87, 551.

PROVIDENCE RIVER AND NARRAGANSETT BAY, R. I.— Continued.

Physical Characteristics.

Tide-gauge record at Providence from April 12, 1863, to May 31, 1863, '80, 387.

Projects.

The early project dates from the first appropriation in 1862 and proposed, by dredging, the formation of a channel at the "Crook" and "Point of Long Bar" 9 feet deep at mean low water; under subsequent appropriation to 1874 it was expanded to depths of 12 and 14 feet, together with the removal of Bulkhead Rock. The amount appropriated between 1862 and 1873, inclusive, was \$59,000, '71, 728; '79, 307, 730-734; '80, 383; '81, 82.

No appropriations were made between 1873 and 1878.

In 1878 it was proposed to form, by dredging, a wide channel 23 feet deep at low water in the middle, from Providence to the sea. Estimated cost, \$500,000, '78, 48, 231-237; '79, 308; '80, 383; '82, 557.

In 1882 Lieut. Col. Warren proposed increasing the channel from Fox Wharf at Providence to the ocean to a width of 300 feet and a depth of 25 feet at mean low water, and the formation of an anchorage basin between Fox and Field's Points, thereby increasing the estimated cost of 1878 to \$675,000, '82, 556-558; '84, 622; '86, 602; '87, 550.

Surveys.

Of river from Field's Point to Conimicut Point, '83, 484.

Of harbor between Fox and Field's Points, 1885, '85, 597.

MAPS.

'81, 558; '84, 622; '85, 599.

PROVINCETOWN HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 445.)

Appropriations.

1826-79.....	\$160,328.44
1880.....	500.00, '80, 354.
1881.....	5,000.00, '81, 531.
1882.....	5,000.00, '82, 526.
1884.....	2,000.00, '84, 520.
1886.....	3,000.00, '86, 577.

Total..... 175,828.44

1888..... 7,000.00, act of August 11, 1888.

Appropriations prior to 1880, '80, 514.

Commerce.

Commerce to be benefited by improvement, '82, 526.

Contracts.

1880. J. H. White, for rubble-stone, at \$1.24 and \$1.39 per ton, '81, 532.

1881. C. M. Holden, for bowlders, at \$1.72 per ton, '82, 527.

1883. J. H. White, for brush and stone, '83, 460.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 71; '81, 76; '82, 76; '83, 71; '84, 77; '85, 64; '86, 65; '87, 30.

ENGINEERS IN CHARGE.

Col. G. Thom, 1871-'83. Reports, '80, 353; '81, 530; '82, 525.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 458; '84, 518; '85, 513.

Lieut. Col. G. L. Gillespie, 1886-'—. Reports, '86, 574; '87, 528.

Operations.

1881-'82. 1,753 tons stone placed in bulkhead at Long Point, '82, 526.

1882-'83. 1,085 tons stone placed in bulkhead, extending same 367 feet, '83, 458.

1883-'84. 276 tons stone placed in bulkhead, '84, 519.

1884-'85. Extensive repairs to dike at Able Hill and breakwater at Long Point; breaches in beach closed by 148 linear feet of brush bulkheads, '85, 514.

1885-'86. No operations, '86, 574.

1886-'87. 103 linear feet of sand-catch work built, '87, 529.

Projects.

The object for which appropriations have been made is the preventing or arresting of the movement of sand by the wind and waves, and the consequent protection of Provincetown Harbor, by the perpetuation of its low shore-lines.

PROVINCETOWN HARBOR, MASS.—Continued.**Projects—Continued.**

The works of preservation have consisted mainly of detached bulkheads of timber and stone, jetties of wood and brush, dikes, sand-catch fences, and beach-grass planting.

The earliest appropriation was made in 1826. Between this date and 1864 \$32,850 was appropriated for the construction of jetties and sand-catches, '66, iii, 28. In 1866 the project for the protection of Beach Point and Long Point by the construction of bulkhead jetties was adopted, '66, ii, 29; '67, 464.

In 1869 the construction of a dike at High Head was undertaken to prevent a breach through the outer beach across the salt meadows and East Harbor Creek, '69, 60, 420.

In 1872 a dike was built at Abel Hill across the head of Lancy Harbor to prevent the flow of the tide and sand into the inner harbor, '72, 950.

Under subsequent appropriations the works of protection have been extended and maintained.

From 1864 to 1886, inclusive, \$139,478.44 was appropriated, '86, 575; '87, 528.

MAPS.

'86, 576.

PULTNEYVILLE HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 447.)

Appropriations.

1870-'79	\$62,000
1880.....	3,000, '80, 2209.
1881.....	2,000, '81, 2439.
1882.....	4,000, '82, 2446.

Total 71,000

Appropriations prior to 1880, '81, 2438.

Contracts.

1879. C. F. Dunbar, for dredging, at 18 cents per cubic yard, '80, 2208.

1881. F. B. Gay, for iron, '81, 2440. W. J. Harris, for pier extension, '81, 2440. W. J. Harris, for material, '81, 2440. W. D. Taylor, for iron, '81, 2440. W. J. Harris, for pier extension, '81, 2440.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 231; '81, 317; '82, 312; '83, 320; '84, 324; '85, 349; '86, 343; '87, 309.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1875-'83. Reports, '80, 2208; '81, 2437; '82, 2445.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1944; '84, 2138.

Capt. E. Maguire, 1885. Reports, '85, 2273; '86, 1889.

Capt. C. F. Palfrey, 1887-'—. Report, '87, 2374.

Operations.

1879-'80. West pier extended 92 feet; gap of 86 feet between east pier and Reynolds's Wharf closed by pier-work; 20,000 cubic yards sand and stone dredged from channel entrance, '80, 2208.

1880-'81. No operations, '81, 2437.

1881-'82. West pier extended 183 feet, '82, 2445.

1882-'84. No operations, '83, 1944; '84, 2138.

1-84-'85. Repairs to west pier, '85, 2273.

1885-'87. No operations, '86, 1889; '87, 2374.

Projects.

By Maj. Bowen, 1872, for construction of a pier to be connected with the western shore by a breakwater, both to be 20 feet wide; also for dredging at an estimated cost of \$27,000; modified in 1872 by the addition of an east pier parallel to, and 200 feet from, the west pier, '72, 255. The original project for the formation of a harbor was estimated to cost \$59,000, '74, i, 250, but was subsequently increased, in 1875, to \$71,000, '75, i, 334; '84, 2138.

Total amount appropriated from 1870 to 1886, inclusive, \$71,000.

Surveys.**MAPS.**

'80, 2208; '81, 2440.

PUNGOTEAGUE CREEK, VA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 151.

ENGINEER IN CHARGE.

Lient. Col. W. P. Craighill. Report, '84, 952.

ASSISTANT.

J. L. Seager. Report, '84, 952.

Plans.

In 1882 Lient. Col. Craighill reports the creek as unworthy of improvement and not a public necessity, '84, 953.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Lient. Col. Craighill, '84, 952.

PUYALLUP RIVER, WASH.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 369

ENGINEER IN CHARGE.

Capt. C. F. Powell, 1884. Report, '85, 2417.

Physical Characteristics.

Description of river, '85, 2417.

Plans.

Capt. Powell, 1884, reports the river worthy of improvement to the extent of snagging operations as far up-stream as the county bridge. Estimated annual cost, \$3,000, '85, 2419.

Surveys.

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Capt. Powell, '85, 2417.

•

QUEENSTOWN, MD.—IMPROVEMENT OF HARBOR AT.

(Continued from Vol. I, p. 449.)

Appropriations.

1871-'79..... \$14,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 100; '81, 133; '82, 130; '83, 135.

ENGINEER IN CHARGE.

Lient. Col. W. P. Craighill, 1870-'—. Reports, '80, 623; '81, 860; '82, 843; '83, 669.

Operations.

1879-'80. Dredging resumed, '80, 623.

1880-'81. Channel 100 feet wide and 8 feet deep at mean low water dredged from Chester River to inner harbor, '81, 860.

1881-'83. No operations, '82, 843; '83, 669.

Projects.

By Maj. Craighill, 1870, for the formation, by dredging, of a channel 100 feet wide and 8 feet deep from Chester River to the steam-boat wharf, '71, 612-614. Modified in 1879 to provide for straightening the channel, '79, 488.

QUINCY HARBOR AND BAY, ILL. (See MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER.)

QUINTICO CREEK, VA.—SURVEY OF.**Commerce.**

Value of locality as an ice-harbor, '84, 1012.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1010, 1011.

Physical Characteristics.

Description of creek, '84, 1010.

Plans.

By S. T. Abert, 1883, for the formation of a turning-basin 300 feet wide and 18 feet deep, with an additional width of 130 feet and 11 feet deep to serve as an ice-harbor. Estimated cost, \$33,453, '84, 1012.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of S. T. Abert, '84, 1010.

RACCOON RIVER, N. J.—IMPROVEMENT OF.**Appropriations.**

1882..... \$3,000, '83, 646.

Engineers.

CHIEF OF ENGINEERS.

Reports, '83, 126; '84, 135; '85, 124; '86, 121; '87, 83.

ENGINEERS IN CHARGE.

Lieut. Col. G. Weitzel, 1882-'84. Report, '83, 646.

Maj. W. H. Heuer, 1884-'85. Report, '84, 839.

Lieut. Col. H. M. Robert, 1885-'—, Reports, '85, 851; '86, 844; '87, 810.

ASSISTANTS.

E. A. Gieseler. Report, '83, 647.

A. Stierle. Report, '84, 839.

Operations.

1882-'87. No operations; funds withheld until further appropriations are made, '87, 810.

Plans.

By Col. Weitzel, 1883, for improvement of Raccoon River by excavation of a channel 3 feet deep at low water, with a bottom width of 40 feet, from the mouth up to Sweedsboro' Railroad Bridge. Estimated cost, \$17,940, '83, 649; '87, 810.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under direction of Lieut. Col. Weitzel, '83, 646.

RACINE HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 450.)

Appropriations.

1844-79	\$201,285
1880	6,000, '80, 1938.
1881	6,000, '81, 2127.
1882	7,000, '82, 2160.
1884	7,000, '84, 1868.
1886	10,000, '86, 1683.

Total 237,285

1888..... 10,000, act of August 11, 1888.

Commerce.

General and local commerce benefited by harbor, '81, 2127.

RACINE HARBOR, WIS.—Continued.**Contracts.**

1879. Knapp & Gillen, for pier extension, '80, 1938.
 1881. Knapp & Gillen, for superstructure construction, '81, 2127.
 1884. G. H. Sager, for superstructure reconstruction, '85, 2020.
 1886. S. O. Dixon, for dredging, at 22½ cents per cubic yard, '86, 1683.
 H. B. Herr & Co., for superstructure reconstruction, '87, 2070.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 207; '81, 281; '82, 276; '83, 285; '84, 285; '85, 308; '86, 302; '87, 268.

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1870-'84. Reports, '80, 1935; '81, 2126; '82, 2159; '83, 1707.

Capt. W. L. Marshall, 1884-'—. Reports, '84, 1867; '85, 2019; '86, 1682; '87, 2069.

ASSISTANT.

W. H. Hearing. Reports, '80, 1936; '81, 2126; '82, 2160; '83, 1708; '84, 1863; '85, 2121; '87, 2071.

Operations.

1879-'80. 25,931 cubic yards material dredged from channel between piers; one 50-foot crib sunk in extension of north pier and superstructure built over same, '80, 1936.

1880-'81. 50 linear feet of crib-work added to north pier and damages to pier by collision repaired, '81, 2126.

1881-'82. 50 linear feet superstructure built; 7,757 cubic yards material dredged from between the piers, '82, 2160.

1882-'83. Repairs to crib at eastern end of south pier, '83, 1708.

1883-'84. 17,466 cubic yards material dredged from between the piers; repairs to east end of north pier, '84, 1866.

1884-'85. 340 linear feet of north pier superstructure cut down and rebuilt, '85, 2021.

1885-'86. Dredging between the piers continued under S. O. Dixon's contract, '86, 1682.

1886-'87. Dredging completed under Dixon's contract; 745 linear feet of south pier superstructure rebuilt, '87, 2070.

Projects.

The original project of 1843 proposed the formation of an entrance by the extension of two piers from the mouth of the river, with dredging between the piers, so as to give a channel 12 feet deep (S. Doc. 42, 35th Cong., 1st session, p. 62). The modifications of this project have been to secure increased channel depths up to 16 feet, '66, i, 17; iv, 121; '67, 22; '72, 127; '77, 102, 187.

The total amount appropriated from 1844 to 1886, inclusive, has been \$237,285. The estimated amount required for completion of project, \$25,000, '86, 303; '87, 2071.

Surveys.**MAPS.**

'83, 1707; '84, 1969; '85, 2020.

RAHWAY RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 452.)

Appropriations.

1879.....	\$10,000
1880.....	10,000, '80, 544.
1881.....	10,000, '81, 705.
1882.....	7,000, '82, 696.

Total..... 37,000

Commerce.

Improvement beneficial to shippers but commerce not increased, '86, 784.

Contracts.

1879. E. G. Brown, for dredging, at 37 cents per cubic yard, '80, 544.

1880. J. Van Patten, for sand, gravel, mud, and stone removal, at 85½ cents per cubic yard, '81, 705.

1881. W. Chamberlain, for gravel and rock removal, at 63 cents, \$2, and \$3 per cubic yard, '82, 696.

1882. W. Chamberlain, for dredging, at 78 cents per cubic yard, '83, 579.

RAHWAY RIVER, N. J.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 87; '81, 110; '82, 111; '83, 103; '84, 115; '85, 106; '86, 109; '87, 70.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1879-'80.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 544; '81, 704.

Lieut. Col. G. L. Gillespie, 1882-'86. Reports, '82, 695; '83, 579; '84, 747; '85, 753.

Lieut. Col. W. McFarland, 1886. Report, '86, 783.

Lieut. G. McC. Derby, 1886-'—. Report, '87, 769.

Operations.

1879-'80. 2,733 cubic yards material dredged from the channel, '80, 544.

1880-'81. Dredging recommenced under 1881 contract, '81, 705.

1881-'82. 16,978 cubic yards material dredged from the channel, '82, 695.

1882-'83. 10,467 cubic yards material dredged from the channel, '83, 579.

1883-'84. 4,144 cubic yards material dredged from the channel, '84, 747.

1884-'87. Operations suspended, '86, 110, 747; '87, 769.

Projects.

By Col. Macomb, 1878, for the formation of a channel 8 feet deep at mean high water and 125 feet wide from Bricktown to Main Street Bridge in Rahway. Estimated cost, \$37,000, '79, 485; '80, 87.

Increased in 1882 on account of extra cost for dredging by \$29,250, '82, 696; '87, 769.

RANCOCAS RIVER, N. J.—IMPROVEMENT OF.**Appropriations.**

1881..... \$10,000, '81, 795.

1882..... 10,000, '82, 778.

Statement of appropriations, '87, 806.

Commerce.

Statistics, '84, 834.

Contracts.

1881. American Dredging Company, for dredging, at 55 cents per cubic yard, '81, 796.

1882. American Dredging Company, for dredging, at 32 cents per cubic yard, '83, 635.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 98; '81, 126; '82, 123; '83, 124; '84, 133; '85, 123; '86, 120; '87, 82.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1880-'82. Reports, '80, 795, 796; '81, 795.

Capt. W. Ludlow, 1882-'83. Report, '82, 777.

Lieut. Col. G. Weitzel, 1883-'84. Report, '80, 635.

Maj. W. H. Heuer, 1884-'85. Report, '84, 833.

Lieut. Col. H. M. Robert, 1885-'—. Reports, '85, 849; '86, 841; '87, 807.

ASSISTANT.

A. Stierle. Reports, '83, 635; '84, 834.

Operations.

1881-'82. 723 linear feet of dike built from north bank to upper end of Hammill's Island; 17,000 cubic yards material dredged from the channel, '82, 778.

1882-'83. 25,983 cubic yards material dredged from the channel, '83, 636.

1883-'84. Removal of "Coates Bar" completed, '84, 834.

1884-'87. No operations, '85, 849; '86, 841; '87, 807.

Physical Characteristics.

Description of river and obstructions therein, '81, 796.

Projects.

By Col. Macomb, 1881, for excavation of a channel from 150 to 200 feet wide, with a low-water depth of 6 feet from mouth to Centreton, a distance of 7½ miles, and a 5-foot low-water channel from thence to Mount Holly. Estimated cost, \$1,236, '81, 798.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Col. Macomb, '81, 796.

RAPPAHANNOCK RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 453.)

Appropriations.

1852-'79	\$93,500
1880	25,000, '80, 766.
1881	15,000, '81, 964.
1882	17,000, '82, 1027.
1884	20,000, '84, 986.
1886	20,000, '86, 909.

Total..... 190,500

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '80, 765; '87, 937.

Commerce.

Extent and character of commerce, '80, 766.

Contracts.

1880. A. Kishpaugh, for dike construction, '80, 764. H. Birch, for dredging, at 194 cents per cubic yard, '81, 961. A. Kishpaugh, for dike construction, '81, 961.

1887. A. Kishpaugh, for crib and pile dike construction, at \$4.70 and \$5.85 per linear foot, respectively, '87, 936.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 113; '81, 153; '82, 148; '83, 154; '84, 156; '85, 145; '86, 142; '87, 108.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1875-'—. Reports, '80, 760; '81, 957; '82, 1017; '83, 802; '84, 985; '85, 971; '86, 906; '87, 935.

Operations.

History of operations, '80, 761; '82, 1022.

1879-'80. Dikes 4 and 5 completed, 56 snags and 1 wreck removed from the Spottswood Bar reach; Fredericksburgh Dike No. 6 built; construction of Spottswood Bar spur-dams commenced; 80 feet of crib-dike built, '80, 764.

1880-'81. Spottswood Bar spur-dikes completed; Dikes A, B, C, D, E, and F completed; 20,572 cubic yards material dredged at Spottswood and Fredericksburgh bars, '81, 962.

1881-'82. 1,580 linear feet of Diike K, deflecting Diike I, Spur-dike G, and Dikes H and L built; 62,008 cubic yards material dredged at Fredericksburgh and Spottswood bars, '82, 1019, 1020, 1021.

1882-'83. 1,310 linear feet of Diike No. 5 removed; crib-dike and 155 linear feet of deflecting log dike built; dike at Pratt's Bar repaired; 170 linear feet of wattling built, and 4 snags removed from Spottswood Bar; 6 log dikes built at Castle's Ferry Bar, aggregating 1,046 feet; 52,307 cubic yards material dredged from Fredericksburgh, Pollock's, and Castle's Ferry bars, '83, 810.

1883-'84. No operations, '84, 985.

1884-'85. Repairs to following dikes by hired labor: Fredericksburgh, Pollock's Bar, Bernard's Bar, Pratt's Reach Bar, Castle's Ferry Bar, Spottswood and Farleyville bars; a total length of 518 feet of diking also built by contract; 3,867 cubic yards material dredged from the turning-basin, '85, 973, 974, 975.

1885-'86. 39,494 cubic yards material dredged from Fredericksburgh and Spottswood bars; dike repaired at Fredericksburgh Bar, and mats sunk at Spottswood and Farleyville, '86, 907, 908.

1886-'87. Crib and pile dike construction commenced under contract; extensive repairs made to existing dikes; 26 snags and 125 trees cut and removed, '87, 937.

Projects.

By Maj. Craighill, 1871, for the formation of a channel 100 feet wide and 10 feet deep at low water by dredging through shoals, removal of rocks, and by training dikes at various points, '71, 596; '72, 689.

By S. T. Abert, 1879, for the formation of a channel 100 feet wide and 10 feet deep over the bars between Fredericksburgh and Port Royal to be secured by dredging and the construction of dikes and wing-dams; also for increasing the channel width to 200 feet, and the depth to 15 feet below Port Royal, and maintenance of same by construction of training dikes. Estimated cost, \$291,000, '79, 85, 613; '80, 764; '87, 935. Amount appropriated from 1871 to 1886, inclusive, \$187,500; amount estimated to complete project, \$194,000, '86, 142; '87, 937.

Surveys.

Of bars at Nanzatico Reach and Naylor's Hole, 1885, '86, 909.

RAPPAHANNOCK RIVER, VA.—Continued.**MAPS.**

Fredericksburgh and Spottswood bars, '80, 760; '81, 964.
 Fredericksburgh, Spottswood, Farleyvale, and Castle's Ferry bars, '83, 812.
 Rappahannock and Spottswood bars, '85, 976.
 Fredericksburgh and Pollock's bars, '87, 937.
 Fredericksburgh, Spottswood, and Farleyvale bars, '86, 908.
 Nanzatico Reach, '86, 908.

RARITAN BAY, N. J.—IMPROVEMENT OF.**Appropriations.**

1881.....	\$50,000, '81, 715.
1882.....	50,000, '82, 704.
1884.....	20,000, '84, 753.
1886.....	37,500, '86, 769.
Total.....	157,500
1888.....	25,000, act of August 11, 1888.

Contracts.

1881. Atlantic Dredging Company, for dredging, at 28 cents per cubic yard, '81, 716.
 1882. Atlantic Dredging Company, for dredging, at 22 cents per cubic yard, '83, 586.
 1884. Atlantic Dredging Company, for dredging, at 16 cents per cubic yard, '85, 759.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 112; '82, 113; '83, 110; '84, 117; '85, 108; '86, 106; '87, 66.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'82. Report, '81, 715, 717.

Lieut. Col. G. L. Gillespie, 1882-'86. Reports, '82, 703; '83, 585; '84, 752; '85, 757.

Lieut. Col. W. McFarland, 1886-'— . Reports, '86, 765; '87, 749.

ASSISTANT.

A. Doerflinger. Report, '81, 718.

Operations.

History of operations, '87, 750.

1881-'82. 166,346 cubic yards material dredged from channel across shoal, '82, 704.

1882-'83. 56,200 cubic yards material dredged from north side of channel, '83, 586.

1883-'84. 146,026 cubic yards material dredged from channel, '84, 752.

1884-'85. 112,657 cubic yards material dredged from western end of channel across the shoal, '85, 756.

1885-'87. No operations, '86, 768; '87, 752.

Projects.

By Lieut. Col. Michler, 1880, for improvement of Raritan Bay by excavation of a channel 300 feet wide and 21 feet deep at mean low water through the shoal off Seguin Point. Estimated cost, \$126,500, '81, 715, 717; '87, 750.

By Lieut. Col. Gillespie, 1884-'85, for excavation of a channel 300 feet wide and 21 feet deep from Great Beds Light to wharves at Perth Amboy, and a 15-foot channel from outside of Great Beds Light to South Amboy. Estimated cost, \$114,000, '84, 753; '85, 758; '87, 751.

Surveys.

From Perth and South Amboy to main ship-channel off Great Kills, Raritan Bay, ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Michler, '81, 717.

RARITAN RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 454.)

Appropriations.

1886-'79.....	\$273,963
1880.....	100,000, '80, 518.
1881.....	25,000, '81, 659.
1882.....	25,000, '82, 676.

RARITAN RIVER, N. J.—Continued.**Appropriations—Continued.**

1884.....	\$35,000, '84, 755.
1886.....	26,250, '86, 776.
Total	485,213
1888.....	50,000, act of August 11, 1888.

Commerce.

Benefit of improvement to navigation, '85, 761.

Contracts.

1879. W. H. Wood, for dike construction, '80, 516.

1880. J. Van Patten, for dredging, at 24½ cents per cubic yard, '81, 659.

1882. J. D. Leary, for dredging, at 13 cents per cubic yard, '82, 552.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 84; '81, 106; '82, 107; '83, 99; '84, 118; '85, 109; '86, 107; '87, 71.

ENGINEERS IN CHARGE.

Col. J. Newton, 1874-'84. Reports, '80, 516; '81, 655; '82, 673; '83, 549.

Lieut. Col. G. L. Gillespie, 1884-'86. Reports, '84, 754; '85, 759.

Lieut. Col. W. McFarland, 1886. Report, '86, 769.

Lieut. G. McC. Derby, 1886-'— . Report, '87, 771.

Operations.

1879-'80. 2,600 linear feet pile-dike completed; 241,121 cubic yards material dredged at "the Stakes," the "Middle Ground," and at Whitehead's sand dock, '80, 516.

1880-'81. Diking at "the Stakes" completed; dredging and rock blasting at Whitehead's, and dredging in the "Middle Ground" in progress, '81, 658.

1881-'82. 57,700 cubic yards material dredged from the channel at "Middle Ground;" 24,337 cubic yards rock blasted and removed from Whitehead's sand dock, '82, 674.

1882-'83. 46,740 cubic yards material dredged from cut in south channel, '83, 550.

1883-'84. 6,929 cubic yards material dredged from south channel; 3,173 cubic yards of stone drilled, blasted, and removed at Whitehead's, '84, 755.

1884-'85. 67,034 cubic yards material dredged from south channel, '85, 760.

1885-'86. 6,392 cubic yards rock blasted and removed, '86, 774.

1886-'87. No operations except surveys, '87, 772.

Physical Characteristics.

Description of the Raritan, '86, 769.

Projects.

By Lieut. Col. Newton, 1874, for permanent improvement of river by excavation of a 10-foot mean low-water channel 200 feet wide from mouth to New Brunswick, a distance of 12½ miles, and excavation of a tidal basin above New Brunswick Locks by dredging, rock removal, and diking. Estimated cost, \$2,093,662, '74, ii, 179; '82, 675; '86, 770.

Modified in 1881 to provide for dredging south channel so as to form a channel 100 feet wide and 5½ feet deep at mean low water, '87, 771.

Surveys.**MAPS.**

Raritan River, from mouth to New Brunswick, '85, 760.

RED BANK CREEK, PA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '81, 263.

ENGINEER IN CHARGE.

Maj. W. E. Merrill. Report, '81, 1959.

ASSISTANT.

J. Worrall. Report, '81, 1961.

Physical Characteristics.

Description of the Apalachian region, '81, 1962.

Plans.

In 1881 Maj. Merrill did not consider it advisable to inaugurate bear-trap dams for the improvement of the creek, '81, 1961.

Surveys.

Examination ordered by act of June 14, 1880. Made under direction of Maj. Merrill, '81, 1959.

RED FISH BAR, TEX. (See GALVESTON BAY SHIP CANAL.)

RED LAKE RIVER, MINN.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 229.

ENGINEER IN CHARGE.

Maj. C. J. Allen. Report, '87, 1724.

ASSISTANT.

R. Davenport. Report, '87, 1725.

Physical Characteristics.

Description of river, '87, 1724.

Plans.

In 1886 Maj. Allen considered that the cost of improving the river would be out of all proportion with the present requirements of the locality, '87, 1726.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Maj. Allen. '87, 1724.

RED RIVER (LITTLE), ARK.—SURVEY AND IMPROVEMENT OF.

(Continued from Vol. I, p. 580.)

Appropriations.

1886..... \$3,000, '87, 1505.

1888..... 5,400, act of August 11, 1888.

Commerce.

Justification of the improvement, '85, 1612.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 219; '82, 217; '85, 252; '87, 204.

ENGINEERS IN CHARGE.

Capt. T. H. Handbury. Report, '82, 1587.

Capt. H. S. Tabor. Reports, '85, 1587; '87, 1503.

ASSISTANTS.

F. W. Tuttle. Report, '82, 1588.

M. A. Orlopp. Report, '85, 1613.

Operations.

History of previous operations, '87, 1503.

1886-'87. Removal of snags from below Judsonia and of bowlders from shoal 3 miles below Judsonia, '87, 1504.

Physical Characteristics.

Description of river, '82, 1588; '85, 1613.

Plans.

By Capt. Handbury, 1881, for the removal of snags and similar obstructions below Judsonia and the removal of bowlders and loose rock from Utley's Shoal and Knight's Bar. Estimated cost, \$16,100, '82, 1587, 1589.

Projects.

By Capt. Taber, 1884, for the improvement of three shoals above Judsonia by the removal of obstructing bowlders and cutting a channel 3 feet deep through the shoals below Judsonia. Estimated cost, \$8,400, '85, 1612, 1616; '87, 1504.

Surveys.

Examination ordered by act of March 3, 1881. Made under the direction of Capt. Handbury, '82, 1587.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Taber, '85, 1612.

RED RIVER, LA.—IMPROVEMENT OF THE MOUTH OF.

(See also MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF PASSES.)

(Continued from Vol. I, p. 455.)

Appropriations.

1878..... \$150,000, '78, 632.

1879..... 40,000, '79, 961.

RED RIVER, LA.—Mouth of—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 151; '81, 205; '82, 203.

BOARD OF ENGINEERS.

Convened April, 1880, to consider plan for the permanent improvement of the mouth of the river. Report, '80, 1234 (Cols. Tower and Newton and Maj. Abbot.)

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaure, 1878-'82. Reports, '80, 1282, 1283; '81, 1389; '82, 1511, 1515. Transferred to Mississippi River Commission June 30, 1882, '82, 1512.

ASSISTANTS.

E. Flood. Report, '81, 1390.

M. Rees. Report, '81, 1391.

F. S. Burrowes. Report, '82, 1522.

H. St. L. Coppee. Report, '82, 1531.

Operations.

1879-'80. 57,800 cubic yards removed by dredge from bars at month, '80, 1282.

1880-'81. 38,574 cubic yards dredged from inner bar, '81, 1389, 1390.

1881-'82. Dredging operations continued, '82, 1511. Work transferred to Mississippi River Commission, '82, 1512.

Physical Characteristics.

Description of the junction of the Red River with the Mississippi River, '80, 1229; '81, 1391; '82, 1524. Separation of the two rivers in 1847, '80, 1292, 1295.

Unity of the Red and Atchafalaya rivers, '80, 1289, 1293, 1295.

Direction of currents at mouth of Red River, '81, 1391.

Discharge of Red River, '81, 1394, 1399.

Discharge of Atchafalaya River, '81, 1394, 1399.

Plans.

By Maj. Benyaure, for the rectification of the Red and Atchafalaya rivers at their junction with the Mississippi River, '80, 1288-1299. Considered by Board of Engineers of 1-80, '80, 1284-1288.

Projects.

The Board of Engineers of 1880 recommended continuation of dredging at mouth of the Red River as a temporary improvement, '80, 1288.

Surveys.

Survey of 1880, '81, 1391.

Survey of 1882, '82, 1513, 1519, 1531.

Of mouth of Grand Bayou ordered by act of March 3, 1881. Made under direction of Maj. Benyaure, 1881, '82, 1515.

RED RIVER, LA. AND ARK.—IMPROVEMENT OF, EXCEPT AT MOUTH.

(Including removal of raft, closing Tone's Bayou, removing snags and other obstructions, improvement of Upper Red River at falls near Alexandria and Red River above Fulton, Ark.)

(Continued from Vol. I, p. 455.)

Appropriations.

1828-75. Removal of raft.....	\$833, 137. 50
1872-77. Closing Tone's Bayou	24, 500. 00
1876-79. Removing raft and closing Tone's Bayou	80, 000. 00
1878-79. Removing snags and other obstructions	47, 500. 00
1879. Improvement of upper river above raft....	10, 000. 00
{ Removing raft and closing Tone's Bayou	25, 000. 00, '80, 1280.
1880. { Removing obstructions	60, 000. 00, '80, 1304.
{ Upper Red River	10, 000. 00, '80, 1305.
{ Removing raft and closing Tone's Bayou	10, 000. 00, '81, 1403.
1881. { Removing obstructions	10, 000. 00, '81, 1404.
1882. Improving Red River, La.....	75, 000. 00, '82, 205.
1884. Improving Red River, La.....	75, 000. 00, '84, 1323.
{ Improving Red River, La.....	75, 000. 00, '86, 1342.
1886. { Improving Red River above Fulton, Ark	7, 000. 00, '87, 1502.

Total 1, 342, 137. 50

RED RIVER, LA. AND ARK.—Continued.**Appropriations—Continued.**

1888.	{	Improving Red River above Fulton, Ark ..	\$3,000.00	} act of Aug. 11, 1888.
		From Fulton to Atchafalaya River	55,000.00	
		Completion of survey	35,000.00	

Statement of appropriations since 1872, '87, 1451.

Commerce.

Objections to closing Tone's Bayou, '82, 1541.

Information relating to number of wrecks on river, '87, 1444.

Contracts.

1881. Allen & Blaisdell, for construction of iron-hull snag-boat for \$44,650, '81, 1405. Gervin & Bietry, for construction of earthen dam, closing Tone's Bayou, '81, 1403; '82, 1539. Action relating to destruction of dam in process of construction under this contract, '82, 1540; '85, 1473.

1882. E. P. Doherty, for rock removal, at the falls near Alexandria, at the rate of \$3.45 per cubic yard, '83, 1136.

Engineers.**CHIEF OF ENGINEERS**

Upper Red River. Reports, '80, 152, 158; '81, 207; '82, 205.

Removing raft and closing Tone's Bayou. Reports, '80, 150; '81, 206; '82, 203.

Removing obstructions. Reports, '80, 152; '81, 207; '82, 204.

Improving Red River, La. Reports, '83, 213; '84, 221; '85, 230; '86, 227; '87, 193, 203.

ENGINEERS IN CHARGE.**Upper Red River:**

Maj. W. H. H. Benyaurd, 1879-'82. Reports, '80, 1304; '81, 1406; '82, 1545.

Maj. A. M. Miller, 1882-'— . Report, '83, 1143.

Removing raft and closing Tone's Bayou:

Maj. W. H. H. Benyaurd, 1874-'82. Reports, '80, 1277; '81, 1402; '82, 1538.

Maj. A. M. Miller, 1882-'— . Report, '83, 1138.

Removing obstructions:

Maj. W. H. H. Benyaurd, 1878-'82. Reports, '80, 1302; '81, 1404; '82, 1543.

Maj. A. M. Miller, 1882-'— . Report, '83, 1142.

Improving Red River, La.:

Maj. A. M. Miller, 1882-'84. Reports, '83, 1143; '84, 1321.

Capt. E. Bergland, 1884-'86. Reports, '85, 1471; '86, 1337.

Capt. J. H. Willard, 1886-'— . Report, '87, 1439.

Red River above Fulton, Ark.:

Capt. H. S. Taber, 1884-'— . Reports, '85, 1671, 1623; '87, 1502.

ASSISTANTS.

E. F. White. Reports, '81, 1405; '82, 1544; '84, 1324; '85, 1480.

I. T. Dorey. Reports, '84, 1325; '85, 1482.

I. W. Beamen. Reports, '84, 1327; '85, 1483.

M. A. Orlopp. Report, '85, 1618.

H. Vance. Report, '87, 1447.

Encroachments.

Injury to river by acts of lumbermen, '80, 1278; '82, 1538.

Malicious destruction of dam closing Tone's Bayou, '82, 1540; '85, 231, 1473; '86, 1340.

Action of State enjoining work near Alexandria, '84, 1329.

Legal Proceedings.

Action of State of Louisiana, enjoining work at Alexandria, '84, 1329; '85, 1486.

Operations.

History of operations prior to 1886, '85, 1472; '86, 1338.

1879-'80. On Upper Red River, 1,210 snags, 2,229 logs, and 753 trees removed, '80, 1304. Removal of log-jams in vicinity of raft, '80, 1278. Progress on dam closing Tone's Bayou, '80, 1278. Above Alexandria, 1,340 snags, 495 trees, and 2 wrecks removed, '80, 1302.

1880-'81. On Upper River, 460 snags, 1,526 logs and stumps, and 190 trees removed, '81, 1406. Removal of log-jams at the raft, '81, 1402. No operations at dam closing Tone's Bayou, '81, 1402. Between mouth of Ouachita River and 25 miles below Shreveport, 665 snags, and 1,216 trees and stumps removed, '81, 1404.

1881-'82. No operations on the upper river, '82, 1545. River cleaned at the raft, '82, 1538. At Tone's Bayou, partial completion of dam closing bayou; subsequent destruction of dam, '82, 1339. 1,214 snags and stumps removed from river below Alexandria, '82, 1544.

1882-'83. In the river above Shreveport, 1,904 snags and stumps, 579 trees, 117 jams, and 110 logs were removed, '83, 1136, 1137. Below Shreveport, 336 snags, 3,627 trees, and 3 jams were removed, '83, 1136.

RED RIVER, LA. AND ARK.—Continued.**Operations—Continued.**

- 1883-'84. On upper river, 309 snags, 95 jams, 512 trees, 5,144 stumps and shore-snags removed; below Shreveport, 1,621 snags, 347 trees, 841 stumps, 2 wrecks, and 10 drift-piles removed, '84, 1322, 1325. In vicinity of Alexandria, 2,051 cubic yards of rock removed, '84, 1322, 1328.
- 1884-'85. 40,529 snags, stumps, and trees removed; 27 jams removed at the raft, '85, 1474, 1475, 1480, 1482. Construction and subsequent destruction of dam, closing side outlet at Sale & Murphy's Canal, '85, 1476. Progress of rock removal near Alexandria, '85, 1477, 1483. Partial construction of work at Alexandria for protection of harbor, '85, 1478, 1485.
- 1885-'86. Completion of contract for rock removal at falls near Alexandria, and construction of dam at lower falls, '86, 1340. Progress of work at Alexandria Harbor, '86, 1341. No work done for general improvement of the river, '86, 228.
- 1886-'87. Removal of obstructions by snag-boats from Garland, Ark., to mouth of the Atchafalaya River, '87, 1440. Construction of snag-boat for river above Fulton, '87, 1502.

Physical Characteristics.

- Of the river in vicinity of Falls of Alexandria, '80, 1347.
- Of the river above Fulton, Ark., '85, 1618-1627.
- River slopes, '87, 1449.

Plans.

- Résumé of plans for improvement of river at falls near Alexandria, '80, 1343-1345.
- Plans proposed by Maj. Howell, 1875, for passage of falls, '75, 902; '80, 1345, 1347.

Projects.

- From 1828 to 1852, inclusive, \$533,137.50 was appropriated for the removal of the raft.
- Between 1852 and 1872, no further appropriations were made.
- In 1872, under a renewal of appropriations, the present project for the removal of the raft, and the closing of Tone's Bayou by a dam was adopted, '72, 569; '73, 624, 628, 674; '85, 1472.
- In 1875 it was proposed to protect the city front at Alexandria from erosion by means of stone revetment, '75, i, 906.
- In 1878 the improvement of the river below Fulton, Ark., by the removal of snags and other obstructions was inaugurated, '78, 634.
- In 1879 the improvement of the falls near Alexandria was undertaken, so as to furnish a channel 75 feet wide and 4½ feet deep, '80, 134.
- In 1882 it was proposed to close certain outlets above Shreveport, '82, 1546; '85, 1477.
- In 1884 the improvement of the river above Fulton, Ark., by the removal of snags and similar obstructions was undertaken, '85, 1618, 1622. The amount appropriated for these projects from 1872 to 1886, inclusive, was \$809,000, '87, 1451.

Surveys.

- Survey of falls near Alexandria, La., ordered by act of June 18, 1878. Made under direction of Maj. Benysard, 1879, '80, 1342.
- Survey from mouth to Fulton ordered by act of August 2, 1882, '84, 227. Progress under direction of Capt. Willard, '87, 1446.
- Survey of Fulton, Ark., under direction of Capt. Taber, '85, 1617, 1623.

MAPS.

- From Shreveport to Natchitoches, '82, 1542; '85, 1490.
- Vicinity of Tone's Bayou, '82, 1542; '85, 1490.

RED RIVER between Shreveport, LA., and Fulton, ARK.—EXAMINATION OF CONNECTIONS WITH CLEAR LAKE, BLACK BAYOU, RED BAYOU, BLACK LAKE, AND KELLY BAYOU.

Engineers.

- CHIEF OF ENGINEERS.
Report, '87, 203.
- ENGINEER IN CHARGE.
Capt. J. H. Willard. Report, '87, 1490.

Physical Characteristics.

- Description of the lakes and bayous, with their obstructions, '87, 1490.

RED RIVER between Shreveport and Fulton, etc.—Continued.**Plans.**

Capt. Willard, 1887, reports the streams as unworthy of improvement and not public necessities, '87, 1494.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Willard, '87, 1490.

RED RIVER OF THE NORTH, at Goose Rapids, MINN. and DAK.—IMPROVEMENT OF.**Appropriations.**

1881..... \$20,000, '81, 1761.

1882..... 30,000, '82, 1828.

Balance of \$46,947 65 transferred to improvement of Red River of the North, '87, 229, 1722.

Commerce.

Increase in transportation of grain since commencement of improvement in 1879, '81, 1760.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 244; '82, 240; '83, 248; '84, 248; '85, 271; '86, 262; '87, 229.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1881-'87. Reports, '81, 1760; '82, 1827; '83, 1454; '84, 1612; '85, 1745; '86, 1500; '87, 1721.

Operations.

1881-'86. No operations; total amount appropriated considered too small to warrant the commencement of operations, '84, 1613; '87, 1721. Appropriations transferred to the general improvement of the Red River, '87, 1722.

Plans.

By Maj. Allen, 1879, for construction of lock and dam at Goose Rapids having a lift of 12 feet. Estimated cost, \$219,238, '79, 1191; '81, 1760; '87, 1721.

In 1884 revised plans and estimates were submitted, '84, 1613; '87, 1722.

RED RIVER OF THE NORTH, MINN. AND DAK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 458.)

Appropriations.

1876-'79..... \$65,000.00

1880..... 20,000.00, '80, 1585.

1881..... 18,000.00, '81, 1757.

1882..... 10,000.00, '82, 1822.

1884..... 10,000.00, '84, 1611.

1886..... *46,947.65, '86, 1499.

Total..... 169,947.65

1888..... 20,000.00, act of August 11, 1888.

Statement of appropriations, '87, 1715.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 181, 183; '81, 244, 247; '82, 239; '83, 247; '84, 248; '85, 270; '86, 261; '87, 228, 230.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1879-'— . Reports, '80, 1583; '81, 1756, 1828; '82, 1820; '83, 1448; '84, 1610; '85, 1742; '86, 1496; '87, 1712, 1733.

ASSISTANTS.

C. Wanzer. Reports, '80, 1586; '81, 1757; '82, 1822.

R. Davenport. Reports, '82, 1824; '83, 1450; '87, 1716, 1719, 1734.

* Transferred from Red River of the North at Goose Rapids, '87, 1722.

RED RIVER OF THE NORTH, MINN. AND DAK.—Continued.**Operations.**

- 1879-'80. 57,610 cubic yards material dredged, 219 snags and 4,151 overhanging trees removed, '80, 1584.
 1880-'81. 43,561 cubic yards material dredged and 254 snags and trees removed, '81, 1756.
 1881-'82. 53,217 cubic yards material dredged, '82, 1821.
 1882-'83. 112,539 cubic yards material dredged, 335 stumps and snags and 321 cubic yards bowlders removed, '83, 1449.
 1883-'84. No operations, '84, 1610.
 1884-'85. 36,138 cubic yards material dredged, '85, 1743.
 1885-'86. 36,303 cubic yards material dredged and 4,550 linear feet of training-dam built, '86, 1497.
 1886-'87. 7,174 cubic yards dredged from shoals; 13,822 linear feet wing-dams built, '87, 1718.

Plans.

- In 1886 Maj. Allen considered that the improvement of the 20 miles of river below Fergus Falls could only be accomplished by locks and dams and at a cost incommensurate with the demands of commerce, '87, 1734.

Projects.

- By Maj. Farquhar, 1876, for improvement of the river between Breckenridge and the northern boundary-line, by dredging through bars, removal of snags, logs, bowlders, and similar obstructions. Estimated cost, \$145,310, '79, 1191; '81, 1757. Revised to \$179,310 in 1883, '83, 1450; '87, 1712.

Surveys.

- Examination of Upper Red River of the North, between Fargo, Dak., and Breckenridge, Minn., ordered by act of June 14, 1880. Made, 1880, under direction of Capt. Allen, '81, 1828.

- Examination from Moorhead to Fergus Falls, Minn., ordered by act of August 5, 1886. Made under direction of Maj. Allen, '87, 1733.

RED RIVER, TENN.—IMPROVEMENT OF.**Appropriations.**

- 1881..... \$5,000, '81, 1878.

Commerce.

- River obstructed by bridges unprovided with draws, '81, 1878.
 Commerce unknown and further expenditure not demanded by interests of same, '84, 1659.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 190; '81, 257, 258; '82, 251; '83, 258; '84, 259.

ENGINEER IN CHARGE.

- Maj. W. R. King, 1880-'—. Reports, '81, 1878, 1894; '82, 1861; '83, 1507; '84, 1659.

ASSISTANT.

- C. A. Turrill. Report, '81, 1894.

Obstructions.

- Three bridges not provided with draws, '81, 1878.

Operations.

- 1881-'82. 1,458 cubic yards fish-trap dam, 60 cubic yards solid rock, 1,463 cubic yards loose rock and gravel, and 485 snags and logs removed; 1,664 overhanging trees cut and 1,050 cubic yards rip-rap dam built, '82, 1861.
 1882-'84. No operations, '83, 1507; '84, 1659.

Projects.

- By Maj. King, 1881, for improvement of the Red River from Port Royal to its mouth by removal of snags, logs, overhanging trees, and similar obstructions and construction of riprap dams. Estimated cost, \$10,103, '81, 1878.

Surveys.

- Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. King, '81, 1879.

REDWOOD HARBOR, CAL.—IMPROVEMENT OF.**Appropriations.**

1884..... \$3,000, '85, 2339.
 1886..... 5,000, '86, 1915.
 1888..... 7,400, act of August 11, 1888.

Contracts.

1887. M. J. Madison, for dredging, at 24 cents per cubic yard, '87, 2425.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 334; '85, 358; '86, 352; '87, 318.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell, 1882—'. Reports, '84, 2204; '85, 2338; '86, 1914; '87, 2424.

ASSISTANT:

Lieut. C. F. Palfrey. Report, '84, 2204.

Operations.

1886-87. 19,000 cubic yards dredged from channel, '87, 2424.

Projects.

By Lieut. Col. Mendell, 1882, for improvement of the harbor, by excavation of a channel from the city of Redwood to San Francisco Bay, a distance of 1 mile, being a high-water depth of 7 feet. Estimated cost, \$15,400, '84, 2204.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Lieut. Col. Mendell, '84, 2204.

REEDY ISLAND, FORT PENN, DEL. (See ICE-HARBOR AT REEDY ISLAND.)**REHOBOTH BAY, DEL. (See CHINCOTEAGUE BAY TO DELAWARE BAY.)****RESERVOIRS AT SOURCES OF THE MISSISSIPPI. (See MISSISSIPPI RIVER, RESERVOIRS AT SOURCES OF.)****RICHMOND HARBOR, KENNEBEC RIVER, ME.—IMPROVEMENT OF.****Appropriations.**

1881..... \$10,000, '81, 478.
 1882..... 10,000, '82, 495.

Contracts.

1881. J. Ginn, for rubble-stone, at \$1 per ton, '81, 478. S. F. Purington, for dredging, at 29 cents per cubic yard, '81, 478.
 1882. Kennebec Dredging Company, for dredging, at 40 cents per cubic yard, '83, 416.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 72; '81, 66, 77; '82, 66; '83, 61.

ENGINEERS IN CHARGE.

Col. G. Thom, 1880-'83. Reports, '81, 476, 479; '82, 493.

Col. C. E. Blunt, 1883. Report, '83, 415.

ASSISTANT.

Lieut. W. T. Rossell. Report, '81, 4-0.

Operations.

1881-'82. 3,124 tons rubble-stone delivered in Swan Island wing-dam; 5,300 cubic yards material dredged at foot of Swan Island, '82, 494.

RICHMOND HARBOR, KENNEBEC RIVER, ME.—Continued.**Operations—Continued.**

1882-'83. 38,977 cubic yards material dredged at head and foot of Swan Island and at Hatche's Rocks, completing projected improvement, '83, 416.

Projects.

By Col. Thom, 1880, for improvement of Richmond Harbor by increasing the depth to 11 feet mean low water, by dredging at foot of Swan Island, and to 10 feet at head of island and at Hatche's Rocks. Estimated cost, \$20,000, '81, 477. Project completed in 1883, '83, 416.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Thom, '81, 479.

RICHMOND ISLAND, ME.—HARBOR OF REFUGE AT.

(Continued from Vol. I, p. 460.)

Appropriations.

1852-'79	\$114,000
1880	3,000, '80, 337.
1881	3,000, '81, 490.
Appropriations prior to 1880, '80, 336.	

Commerce.

Importance of work as a harbor of refuge, '81, 490.

Contracts.

1879. H. Hamilton, for granite grout, at \$1.05 per ton, '80, 337.

1880. H. Hamilton and R. S. Smart, for granite grout, at \$1.04 and \$1.09 per ton, '81, 491.

1881. C. H. Bragdon, for granite quarry grout, at \$1.28 per ton, '81, 491.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 67; '81, 69; '82, 68.

ENGINEER IN CHARGE.

Col. G. Thom, 1867-'82. Reports, '80, 336; '81, 489; '82, 499.

Operations.

1879-'80. 2,400 tons granite grout placed in breakwater, '80, 336.

1880-'81. 1,827 tons granite grout placed in breakwater, '81, 489.

1881-'82. 2,020 tons granite quarry grout placed in the breakwater, completing project by a total of 68,176½ tons, '82, 499.

Projects.

By Col. Thom, 1867, for the formation of a harbor of refuge at Richmond's Island, by construction of a rubble-stone breakwater 2,000 feet long, 30 feet wide, and 13 feet above mean low water. Estimated cost, \$93,500, '67, 48, 484; '72, 935; '76, 1,160; '79, 257; '80, 336. Completed in 1882 at a cost of \$110,000, '82, 499.

RIDLEY CREEK, PA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '81, 129.

ENGINEER IN CHARGE.

Col. J. N. Macomb. Report, '81, 828.

Plans.

In 1880 the creek was being improved by private enterprise and Col. Macomb therefore submitted no plan, '81, 828.

Surveys.

Examination ordered by act of June 14, 1880. Made under direction of Col. Macomb, '81, 828.

RINCON ROCK, SAN FRANCISCO HARBOR. (See SAN FRANCISCO HARBOR, CAL.)

RIO GRANDE AT FORT BROWN, TEX. (See FORT BROWN, PROTECTION OF RIVER BANKS FROM ENCROACHMENT AT.)

ROANOKE RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 461.)

Appropriations.

1871-'79	\$45,000
1882	5,000, '83, 831.
1884	3,000, '84, 1001.
1886	20,000, '86, 928.

Total 73,000

1888

40,000, act of August 11, 1888.

Appropriations prior to 1880, '80, 794.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 157, 158; '82, 153, 154; '83, 159; '84, 161, 163; '85, 152; '86, 147; '87, 113, 114.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1874-'— Reports, '80, 794; '81, 980; '82, 1059, 1060; '83, 831; '84, 1001, 1020; '85, 995; '86, 927; '87, 955, 960.

Operations.

Operations suspended from 1878 to 1882.

1882-'83. Dike built at McRae's Landing and old dike repaired, '83, 831.

1883-'86. No operations, '84, 1001; '85, 996; '86, 928.

1886-'87. Removal of obstructions in the Thorougfare and Coshoke Creek begun and in progress, '87, 956.

Physical Characteristics.

Description of river, '82, 1060; '84, 1023.

Plans.

By S. T. Abert, 1882, for the improvement of the river from Clarksville, Va., to Eaton Falls, N. C., so as to provide a channel 35 feet wide and 2½ feet deep at mean low water. Estimated cost, \$181,316, '82, 1065; '87, 961.

By S. T. Abert, 1885, for construction of plant for snag removal, '85, 996; '86, 928; '87, 956.

Projects.

By Maj. Craighill, 1871, for the removal of wrecks, snags, and dangerous rocks between Albemarle Sound and Weldon, '72, 697, 727; '85, 996.

In 1884 S. T. Abert recommended the annual removal of wrecks and snags and the improvement of Big and Little Rocky Bars, '85, 996; '87, 955.

Total amount appropriated from 1871 to 1886, inclusive, \$73,000. Estimated cost for completion of project, \$41,000, '87, 113.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under direction of S. T. Abert, '82, 1060; '87, 960.

Ordered by act of August 2, 1882. Made, 1883, under direction of S. T. Abert, '84, 1022.

From Clarksville, Va., to Eaton Falls, N. C., ordered by act of August 5, 1886. Made under direction of S. T. Abert, '87, 960.

MAPS.

'87, 956.

ROCHESTER AND FREEDOM, PA.—ICE-HARBOR AT.

(See OHIO RIVER AT ROCHESTER AND FREEDOM, PA.)

ROCKAWAY INLET, N. J. (See JAMAICA BAY.)

ROCK ISLAND HARBOR, ILL. (See MISSISSIPPI RIVER FROM PAUL TO DES MOINES RAPIDS.)

ROCK ISLAND RAPIDS, MISSISSIPPI RIVER.—IMPROVEMENT OF.

(See also MISSISSIPPI RIVER BETWEEN DES MOINES RAPIDS AND MOUTH OF ILLINOIS RIVER.)

(Continued from Vol. I, p. 466.)

Appropriations.

1866-'79 \$1,150,650

1880 8,000, '80, 1535.

1881 8,000, '81, 1702.

NOTE.—\$100,000 appropriated for Rock Island Rapids and Des Moines Rapids, Mississippi River, August 30, 1852.

Statement of appropriations, '86, 1428, 1462, 1463.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 173; '81, 233; '82, 231; '83, 238; '84, 241; '85, 263; '86, 252; '87, 219.

ENGINEERS IN CHARGE.

Maj. F. U. Farquhar, 1877-'80, 79, 1132.

Maj. A. Mackenzie, 1880-'— Reports, '80, 1534, 1537; '81, 1701; '82, 1771; '83, 1407; '84, 1572; '85, 1694; '86, 1427; '87, 1625.

ASSISTANTS.

E. F. Hoffman. Reports, '80, 1536; '82, 1772; '83, 1409; '84, 1574.

C. W. Durham. History of the improvement, '86, 1429.

Operations.

1879-'80. 1,513 cubic yards of rock removed at Saint Louis Chain; removal of obstructions washed into the channel by ice; construction and establishment of buoys, '80, 1537.

1880-'81. Detailed surveys to determine location of patches of rock requiring removal; placing of experimental buoys, '81, 1702.

1881-'82. 415 cubic yards rock removed at Saint Louis Chain; establishment of buoys, '82, 1771, 1772.

1882-'83. Maintenance of buoys, '83, 1407, 1409.

1883-'84. Maintenance of buoys, '84, 1572.

1884-'85. Removal of sand from Campbell Chain cut and maintenance of buoys, '85, 1694.

1885-'87. Maintenance of buoys, '86, 1427. Work merged in improvement of Mississippi River from Saint Paul to Des Moines Rapids, '87, 219, 1625.

History of operations from 1866, '85, 1429.

Physical Characteristics.

Description of river at Rock Island Rapids, '80, 1537.

High-water discharge, '81, 1702.

High-water elevation, '86, 1448.

Plans.

By Maj. Mackenzie, 1880, for widening the existing channel of 200 feet to a width of 400 feet. Estimated cost, \$1,258,866, '80, 1538; '86, 1464.

Projects.

The project of 1866 proposed the improvement of the river between Le Claire, Iowa, and Rock Island, Ill., a distance of 14 miles, by the excavation of rock so as to afford a channel at least 200 feet wide and 4 feet deep, referred to low water of 1864, '67, 273-299; '68, 388; '74, i, 315; '80, 1537; '86, 1429. The project was practically completed in 1879 except the removal of small and isolated patches of rock.

The amount appropriated to 1866 was \$1,166,650, '86, 1462, 1463.

History of the work, '86, 1429-1465.

Surveys.

History of early surveys, '86, 1433.

MAPS.

'80, 1538.

Rock Island Rapids, '86, 1436, 1462.

Duck Creek Chain, '86, 1454.

Moline Chain, '86, 1456.

Sycamore Chain, '86, 1457.

Campbell's Chain, '86, 1458.

Smith's and Upper Chain, '86, 1458-1460.

Saint Louis Chain, '86, 1460.

Lower Chain, '86, 1462.

ROCKLAND HARBOR, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 464.)

Appropriations.

1860.....	\$20,000, '80, 332.
1882.....	40,000, '82, 492.
1884.....	40,000, '84, 465.
1886.....	22,500, '86, 537.

Total	122,500
-------------	---------

1888.....	30,000, act of August 11, 1888.
-----------	---------------------------------

Statement of appropriations, '87, 446.

Commerce.

Commerce of Rockland Port, '80, 332.

Contracts.

1881. Bodwell Granite Company, for granite quarry grout, at 74½ cents per ton, '81, 465.

1882. J. F. Hamilton, for granite quarry grout, at \$1.17 per ton, '83, 414.

1884. T. A. Rowe, for stone, at 88 cents per ton, '85, 469.

1887. J. A. Hamilton and R. Soule, for riprap granite, at 67 cents per ton, '87, 448.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 65; '81, 65, 475; '82, '65; '83, 60; '84, 69; '85, 57; '86, 56; '87, 17.

BOARD OF ENGINEERS.

Convened at New York September 10, 1880, to report upon project of Col. Thom for improvement of Rockland Harbor. Report, '81, 463. (Cols. Tower and Newton.)

ENGINEERS IN CHARGE.

Col. G. Thom, 1880-'83. Reports, '80, 331; '81, 464, 466, 467, 472; '82, 492.

Col. C. E. Blunt, 1883-'86. Reports, '83, 413; '84, 464; '85, 467.

Maj. J. A. Smith, 1886-'—. Reports, '86, 536; '87, 446.

Operations.

1880-'81. 13,006 tons granite placed in the Jameson Point breakwater, extending the same 560 feet, '81, 464.

1881-'82. 11,119 tons granite delivered on the Jameson Point breakwater, extending the same 103 feet, '82, 492.

1882-'83. 30,232 tons granite quarry grout delivered in Jameson Point breakwater, extending the same 326 feet, '83, 414.

1883-'84. No operations for lack of funds, '84, 464.

1884-'85. 25,813 tons stone placed in Jameson Point breakwater, extending the same 291 feet, '85, 464.

1885-'86. 39,959 tons of stone placed in Jameson Point breakwater, extending the same 473 feet, '86, 537.

1886-'87. 10,869 tons of stone placed in the breakwater, '87, 447.

Projects.

By Col. Thom, 1880, modified by Board of Engineers, for improvement of harbor by construction of two breakwaters to a height of 5 feet above mean low water, with a width on top of 10 feet, one extending from Jameson Point 1,900 feet southeast and the other extending from South Ledge 2,640 feet towards Jameson Point. Estimated cost, \$550,000, '81, 471, 473; '82, 492; '86, 536.

Revised in 1887, to bring top of breakwaters to plane of high water. Estimated cost, \$650,000, '87, 447.

Surveys.**MAPS.**

'81, 464.

ROCKPORT HARBOR, ME.

Examination ordered by act of August 5, 1886, '87, 22. [\$10,000 appropriated by act of August 11, 1884.]

ROCKPORT, MASS.—HARBOR OF REFUGE AT.

(See SANDY BAY, MASS.)

ROCKY RIVER HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 469.)

Appropriations.

1872-'79 \$35,000
 1880 4,000, '80, 2134.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 226; '81, 309; '82, 304; '83, 312; '84, 315; '85, 339; '86, 334; '87, 300.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1879-'83. Reports, '80, 2132; '81, 2309; '82, 2398.

Maj. L. C. Overman, 1883-'—. Reports, '83, 1905; '84, 2097; '85, 2227; '86, 1862; '87, 2315.

Operations.

History of the work, '80, 2132.

1880-'81. 120 linear feet of crib-work built, 135 linear feet top course superstructure removed, and 175 linear feet replanked, '81, 2310.

1881-'83. No operations, '82, 2398; '83, 1905.

1883-'84. Repairs to piers by hired labor, '84, 2097.

1884-'87. No operations for lack of funds, '85, 2227; '86, 1862; '87, 2316.

Projects.

The project of 1871 proposed the formation of a channel of entrance from Lake Erie 100 feet wide and from 6 to 12 feet deep by the construction of an east pier and dredging, '71, 212; '80, 2133; '81, 2310.

No further appropriation asked for, '80, 2134.

Surveys.**MAPS.**

'81, 2310.

ROEBUCK LAKE, MISS.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 227.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1357.

ASSISTANT.

W. S. Davis. Report, '84, 1358.

Physical Characteristics.

Description of locality, '84, 1358, 1359.

Plans.

In 1883 Capt. Miller, in view of the small amount of commerce to be benefited, did not consider the lake worthy of improvement nor the work a public necessity, '84, 1358.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Miller, '84, 1357.

ROMERLY MARSH, GA.—IMPROVEMENT OF WATER ROUTE THROUGH.**Appropriations.**

1882 \$10,000.00, '83, 917.
 1884 10,000.00, '84, 1113.
 1886 17,475.00, '86, 1105.
 1888 4,633.77, act of August 11, 1888.

Contracts.

1883. Dickerson & Paulson, for dredging, at 18 cents per cubic yard, '83, 917.

1884. P. S. Ross, for dredging, at 21½ cents per cubic yard, '85, 1217.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 179; '82, 179; '83, 179; '84, 186; '85, 186; '86, 185; '87, 148.

ROMERLY MARSH, GA.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. J. C. Post. Report, '83, 918.

Col. Q. A. Gillmore, 1880.— Reports, '81, 1159; '83, 915; '84, 1111; '85, 1215; '86, 1102; '87, 1174.

ASSISTANTS

Capt. T. M. Bailey. Reports, '83, 917; '84, 1113.

Lieut. O. M. Carter. Report, '85, 1217.

Operations.

1882-'83. 12,718 cubic yards material dredged from the cut, '83, 916.

1883-'84. 61,896 cubic yards material dredged from the cut, '84, 1113.

1884-'85. 26,485 cubic yards material dredged from the cut, '85, 1216.

1885-'86. 99,120 cubic yards material dredged from the cut, '86, 1104.

1886-'87. No operations, '87, 1175.

Private and Corporate Work.

Cut made by private enterprise across marsh near Shoal No. 1, '86, 1103; '87, 1175.

Projects.

By Col. Gillmore, 1880, for connection of Romerly Marsh Creek with Wassaw Sound by excavation of a canal 1,156 yards long with a low-water channel of 48 feet width by 7 feet depth. Estimated cost, \$38,720, '81, 1160, 1161.

Surveys.

Examination ordered by act of June 14, 1880. Made, 1880, under direction of Lieut Col. Gillmore, '81, 1159.

MAPS.

'83, 918; '84, 1112; '86, 1104.

RONDOUT HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 470.)

Appropriations.

1872-'79.....	\$91,000
1882.....	2,000, '82, 645.
1884.....	1,000, '84, 701.
1886.....	2,500, '86, 672.

Total..... 96,500

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '80, 495; '87, 664.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 81; '81, 98; '82, 98; '83, 94; '84, 102; '85, 94; '86, 94; '87, 57.

ENGINEERS IN CHARGE.

Col. J. Newton, 1869-'84. Reports, '80, 494; '81, 620; '82, 645; '83, 531.

Capt. J. Mercur, 1884-'85. Report, '84, 700.

Lieut. Col. W. McFarland, 1885.— Reports, '85, 697; '86, 670; '87, 663.

Operations.

History of the work, '80, 494.

1882-'83. Extensive repairs to dikes, '83, 532.

1883-'84. No operations, '84, 700.

1884-'85. Repairs to diking; 923 cubic yards material dredged, '85, 698.

1885-'86. Repairs to dikes and dredging, '86, 671.

1886-'87. No operations, '87, 664.

Projects.

By Lieut. Col. Newton, 1871, for the formation of a channel in prolongation of Rondout Creek, with a mean low-water depth of from 10 to 13½ feet and a width of from 100 to 200 feet, by dredging and the construction of parallel dikes and branch dike. Estimated cost, \$172,500, '72, 811, 812; '80, 495. Project completed in 1880 at a cost of \$90,000, '86, 671; '87, 663.

By Capt. Mercur, 1884, for widening the outlet between the dikes, \$10,000, '84, 700.

Surveys.**MAPS.**

'80, 494; '85, 698.

ROUGE RIVER, MICH.—SURVEY OF.

[§10,000 appropriated by act of August 11, 1888.]

Commerce.

Commercial statistics, '87, 2277.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 229.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe. Report, '87, 2275, 2277.

Plans.

By Lieut. Col. Poe, 1886, for the formation of a dredged channel from 240 to 100 feet wide and 16 feet deep, from the mouth of the river to the bridge of the Saint Louis and Wabash Railroad. Estimated cost, \$31,690, '87, 2278.

Surveys.

Ordered by act of August 5, 1886. Made under direction of Lieut. Col. Poe, '87, 2275.

MAPS.

'87, 2278.

ROUGH RIVER, KY.—SURVEY OF.**Commerce.**

Commercial statistics, '85, 1894, 1901.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 292.

ENGINEER IN CHARGE.

Capt. J. C. Post. Report, '85, 1893, 1894.

ASSISTANT.

L. Duval. Report, '85, 1900.

Legislation.

Act of State of Kentucky ceding all of State's works to United States, '85, 1902.

Plans.

By Capt. Post, 1885, to extend navigation to Green's Mill by the construction of five locks and dams and clearing the banks of the river. Estimated cost from \$270,000 to \$421,000, '85, 1896.

Private and Corporate Work.

Lock and dam built by Rough Creek Navigation and Manufacturing Company, '80, 1814; '85, 1894.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Capt. Post, '85, 1894.

ROUSE'S POINT HARBOR, N. Y.—CONSTRUCTION OF BREAKWATER AT.

(Continued from Vol. I, p. 471.)

Appropriations.

1884..... \$35,000, '85, 2298.

1886..... 20,000, '86, 1900.

1888..... 13,500, act of August 11, 1888.

Commerce.

Necessity for harbor, '84, 2172.

Contracts.

1885. R. F. Hawkins, for breakwater construction, '86, 1899.

1886. J. L. Johnson, for breakwater construction, '87, 2397.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 330; '85, 354, 2304; '86, 348; '87, 313.

BOARD OF ENGINEERS.

Convened at New York January, 1885, to consider site and form of breakwater.

Report, '85, 2302. (Col. Duane, Lieut. Cols. Abbot and Comstock.)

ENGINEERS IN CHARGE.

Maj. W. McFarland. Report, '84, 2172.

Lieut. Col. H. M. Robert. Reports, '84, 2175; '85, 2299.

Maj. M. B. Adams, 1885.—Reports, '85, 2297; '86, 1899; '87, 2397.

ROUSE'S POINT HARBOR, N. Y.—Continued.**Engineers—Continued.****ASSISTANTS.**

J. A. Gillespie. Report, '84, 2173.

W. P. Judson. Report, '85, 2300.

Operations.

1885-'86. Construction of breakwater commenced, '86, 1900.

1886-'87. Construction of breakwater continued, '87, 2397.

Physical Characteristics.

Character of lake bottom at proposed site of breakwater, '85, 2298.

Height of waves, '85, 2300, 2302.

Plans.

By Lieut. Col. Robert, 1884, for a crib-pier breakwater 2,000 feet long, extending from Stony Point. Estimated cost, \$140,000, '84, 2175; '85, 2299.

By Lieut. Col. Robert, for a breakwater of random stone 1,600 feet long, and located about midway between Stony Point and Windmill Point. Estimated cost, \$140,000, '85, 2299.

Projects.

By Board of Engineers, 1885, for a breakwater of random stone about 2,000 feet long, extending from Stony Point towards Windmill Point until the 18-foot curve in the lake is reached. Estimated cost, \$110,000, '85, 2303. Project approved by Secretary of War, '85, 2304.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. McFarland, '84, 2172.

Survey made, 1884, under direction of Lieut. Col. Robert, '85, 2298.

MAPS.

Rouse's Point, '85, 2300; '87, 2398.

ROYAL RIVER, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 471.)

Appropriations.

1871-'79.....	\$20,000
1882.....	10,000, '83, 420.

Contracts.

1883. S. F. Hamilton, for wing-dam construction, '83, 420. A. R. Wright, for dredging, at 25 cents per cubic yard, '84, 467.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 62; '84, 70.

ENGINEER IN CHARGE.

Col. C. E. Blunt, 1883-'84. Reports, '83, 419; '84, 466.

Operations.

1882-'83. 2,227 tons rubble-stone delivered, '83, 420.

1883-'84. 20,000 cubic yards material dredged from the channel, terminating improvement, '84, 466.

Projects.

By Col. Blunt, 1883, for remedying obstructions caused by land-slide opposite Wolf's Point by construction of a rubble-stone wing-dam just above the obstruction, and dredging to direct the current into a new channel. Estimated cost, \$10,000, '83, 419, 420.

RUSH ISLAND BEND, ILL.

Examination ordered by act of August 5, 1886, '87, 215.

SABINE PASS, TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 472.)

Appropriations.

1852-'79.....	\$120,000
1880.....	50,000, '80, 1164.
1881.....	150,000, '81, 1318.

SABINE PASS, TEX.—Continued.**Appropriations—Continued.**

1882	\$150,000, '82, 1422.
1884	200,000, '84, 1250.
1886	198,750, '86, 1281.

Total 868,750

1888 250,000, act of August 11, 1888.

Statement of appropriations, '82, 1422; '87, 1385.

Contracts.

1882. F. A. Hyatt & Co., for jetty construction, at \$2.25 and \$3.90 per cubic yard, '83, 1050.

1884. Louisiana Jetty and Lightering Company, for stone, at \$3.70 per ton, '85, 1420.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 145; '81, 197, 199; '82, 194, 196; '83, 199; '84, 207, 216; '85, 223; '86, 221; '87, 187.

BOARD OF ENGINEERS.

Convened at New York, March 11, 1882, to report upon project submitted by Maj. Heuer for improvement of Sabine Pass. Report, '82, 1438. (Cols. Tower and Newton and Lieut. Col. Abbot.)

Convened at New York December 1, 1884, to report on project by Capt. Turtle for improvement of Sabine Pass. Report, '85, 1420. (Col. Duane and Lieut. Cols. Abbot and Comstock.)

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1872-'81. Report, '80, 1162.

Capt. C. E. L. B. Davis, 1881-'82. Report, '81, 1317.

Maj. W. H. Heuer, 1882-'84. Reports, '82, 1422, 1426, 1427, 1428, '83, 1048.

Capt. T. Turtle, 1884-'85. Report, '84, 1250.

Maj. W. H. Heuer, 1885— . Reports, '85, 1415; '86, 1278, 1284; '87, 1385.

ASSISTANT.

T. L. Raymond. Reports, '83, 1051; '84, 1251; '85, 1421, 1423; '86, 1282, 1286; '87, 1388.

Operations.

History of the work, '80, 1162.

1880-'81. 12-foot channel dredged through Blue Back Bar, '81, 1048.

1881-'82. No operations, '82, 1422.

1882-'83. 10,600 linear feet of brush and stone jetty built, '83, 1048.

1883-'84. 5,474 linear feet brush and stone jetty added to that already built, '84, 1250.

1884-'85. Work on east jetty commenced under 1884 contract, '85, 1421.

1885-'86. East jetty foundation extended 990 feet and top work 350 feet; west jetty raised above high tide for a length of 5,710 feet, '86, 1279.

1886-'87. Foundation course of east jetty extended to a distance of 14,000 feet from shore-line, '87, 1386-1388.

Plans.

By Capt. Heuer, 1882, for a deep-water channel from Sabine Pass to Orange and Beaufort by a dredged channel considered useless with the present demands of commerce, '82, 1426.

By Maj. Stickney, for a water-route connecting Calcasieu River with Sabine Pass considered unworthy of improvement, '84, 1285.

Physical Characteristics.

Tides, '86, 1280.

Perforation of rock used in jetties by marine animal, '87, 1387.

Projects.

By Capt. C. W. Howell, 1875, for the formation, by dredging, of a channel across the bar $2\frac{1}{2}$ miles long, 150 feet wide, and 12 feet deep, '75, i, 947. Dredging operations were in force from 1875 to 1881, during which interval about \$160,000 was expended, '81, 198.

In 1882 Capt. Heuer proposed two high brush and stone jetties, curving from either bank at mouth of Sabine River, parallel with each other and at a distance of 2,000 feet apart; the west jetty to be 18,120 feet in length, and east jetty 19,800 feet in length; also for possible excavation of channel between jetties 20 feet deep and 100 feet wide at bottom; this channel to extend from jetty entrance to 18-foot channel inside the bar. Estimated cost, \$3,177,606, '82, 1436, 1437; '83, 1054.

The Board of Engineers of 1882 favored high jetties without the shore openings proposed by Maj. Heuer, '82, 1439.

-water connection from Sabine Pass to Orange and Beaufort ordered by March 3, 1881. Made, 1882, under direction of Capt. Heuer, '82, 1426.

SABINE PASS, TEX.—Continued.**Surveys—Continued.**

To connect Calcasieu River with Sabine Pass ordered by act of August 2, 1882. Made, 1882, under direction of Maj. Stickney; reported as unworthy of improvement, '84, 1255.

Survey and examination of work, '85, 1416; '86, 1286.

MAPS.

'83, 1054; '85, 1416; '86, 1282.

SABINE RIVER, LA. AND TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 473.)

Appropriations.

1872-'79	\$18,700
1880	5,000, '80, 1195.
1881	7,000, '81, 1323.
1882	4,000, '82, 1424.

Total 34,700

Contracts.

1880. F. A. Hyatt, for cut-off excavation, '80, 1194.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 146, 150; '81, 198; '82, 195; '83, 200; '84, 208; '85, 224; '86, 222; '87, 186.

ENGINEERS IN CHARGE.

Capt. C. W. Howell, 1870-'80. '81, 197.

Maj. S. M. Mansfield, 1880-'82. Reports, '80, 1193, 1199; '81, 1321.

Maj. W. H. Heuer, 1882-'84. Reports, '82, 1422; '83, 1055.

Capt. T. Turtle, 1884-'85. Report, '84, 1255.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1425; '86, 1287; '87, 1383.

ASSISTANT.

J. S. Polhemus. Report, '80, 1195.

Operations.

1879-'80. 42,567 cubic yards material dredged from cut through the bar, '80, 1194.

1880-'81. Cut-off at Dead Bend completed and one at head of Narrows begun, '81, 1322.

1881-'82. Cut-off at the Narrows completed, '82, 1423.

1882-'83. Channel 6 feet deep and 100 feet wide redredged for a distance of 5,600 feet, '83, 1056.

1883-'87. No operations, '84, 1255; '85, 1425; '86, 1287; '87, 1384.

Projects.

By Capt. Howell, 1873, for dredging a channel across the bar at the mouth of the river to a depth of 5 feet, and the removal of snags and obstructions from the river above. Estimated cost, \$56,000, '73, 681; '79, 904, 905; '80, 1195.

By Maj. Mansfield, 1880, for excavation of cut-off from the main river into the Narrows 320 feet long, 40 feet wide, and 5 feet deep; for the formation of two other cut-offs of 100 feet each; removal of snags, logs, and similar obstructions, and construction of pile and brush obstruction across old channel. Estimated cost, \$17,500, '80, 1199. The river not considered susceptible of permanent improvement, '86, 222.

Surveys.

Resurvey ordered by act of March 3, 1859. Made, 1880, under direction of Maj. Mansfield, '80, 1195.

Of Narrows of Sabine River, '80, 1199.

SACJACAUDA CREEK, N. Y.—EXAMINATION OF.**Commerce.**

Commercial statistics, '85, 2283.

Bridges obstructing navigation, '85, 2285.

SACJACAUDA CREEK. N. Y.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 352.

ENGINEER IN CHARGE.

Capt. E. Maguire. Report, '85, 2283.

Plans.

By Capt. Maguire, 1884, for the formation of a dredged channel 1 mile long, 100 feet wide, and 10½ feet deep. Estimated cost, \$26,000, '85, 2286.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Capt. Maguire, '85, 2283.

SACKETT'S HARBOR, N. Y.—IMPROVEMENT OF.**Appropriations.**

1882..... \$7,000, '83, 1953.

1888..... 2,000, act of August 11, 1888.

Contracts.

1883. W. J. Daly, for dredging, at 20 cents per cubic yard, '83, 1954.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 321; '82, 314; '83, 322; '84, 326; '85, 352; '86, 346; '87, 312.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1881-'83. Report, '82, 2489.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1953; '84, 2151.

Capt. E. Maguire, 1885-'87. Reports, '85, 2282; '86, 1894.

Capt. C. F. Palfrey, 1887-'— . Report, '87, 2391.

ASSISTANT.

M. Kingsley. Report, '82, 2490.

Operations.

1882-'83. 8,510 cubic yards material dredged from the harbor, '83, 1953.

1884-'84. 15,500 cubic yards material dredged from the harbor, '84, 2151.

1884-'85. 18-foot crib built and placed upon east end of Ship-House Point Shoal, '85, 2282.

1885-'87. No operations, '86, 1894; '87, 2391.

Projects.

In 1886 and 1887 \$6,000 was expended in clearing wrecks from the harbor, '87, 312.

By Lieut. Col. McFarland, 1881, for improvement of the harbor by dredging the area to within 50 feet of the wharf-line to 12 feet deep at low water. Estimated cost, \$22,000, '82, 2490.

Modified in 1883 by a moving crib placed near end of Ship-House Point, '83, 1953; '87, 2391.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Lieut. Col. McFarland, '82, 2489.

SACO RIVER, ME.—BREAKWATER AT MOUTH OF.

(Continued from Vol. I, p. 474.)

Appropriations.

1877-'79..... \$169,275

1884..... 15,000, '85, 472.

1886..... 12,500, '86, 545.

1887..... 12,500, act of August 11, 1888.

Contracts.

1884. Hamilton & Soule, for 11,000 tons of breakwater stone, '85, 471.

1886. G. W. Andrews, for breakwater stone, '87, 454.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 73; '85, 52; '86, 53; '87, 18.

ENGINEERS IN CHARGE.

Col. G. Thom, 1866-'85. Report, '84, 482, 483.

Col. C. E. Blunt, 1885-'86. Report, '85, 471.

Maj. J. A. Smith, 1886-'— . Reports, '86, 544; '87, 453.

SACO RIVER BREAKWATER, ME.—Continued.**Operations.**

Breakwater partially built between 1836 and 1873, '84, 483; '86, 544.

1884-'85. 3,494 tons of stone placed in breakwater, '85, 471.

1885-'86. 7,281 tons of stone placed in breakwater, '85, 544.

1886-'87. 4,475 tons of stone placed in breakwater, '87, 454.

Plans.

By Col. Thom, 1883, for repair and extension of existing breakwater and formation of dredged channel through adjacent shoals. Estimated cost, \$356,500, '84, 484; '86, 544.

Projects.

By Col. Thom, 1883, for repairs, strengthening, and raising existing breakwater. Estimated cost, \$70,000, '84, 484; '85, 471; '87, 453. Estimate increased, 1887, to \$88,840, '87, 453.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Col. Thom, '84, 483.

SACO RIVER, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 474.)

Appropriations.

1824-'79.....	\$169,275
1886.....	12,500, '87, 458.
1888.....	10,000, act of August 11, 1888.

Contracts.

1887. T. Symonds, for rock removal, at \$10.25 per cubic yard, '87, 459. R. Hamilton, for dredging, at 23 cents per cubic yard, '87, 459.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '86, 58; '87, 19.

BOARD OF ENGINEERS.

Convened at New York April, 1887, to consider project of Maj. Smith. Report, '87, 459. (Cols. Casey and Abbot, Lieut. Col. Houston, Maj. King.)

ENGINEERS IN CHARGE.

Col. C. E. Blunt, 1884-'86. Reports, '84, 484; '86, 552, 553.

Maj. J. Smith, 1886-'—. Report, '86, 546.

ASSISTANT.

C. Berrer. Report, '86, 552, 554.

Operations.

History of early operations, '87, 455.

Plans.

By Lieut. Col. Blunt, 1884, for forming and maintaining a channel 5 feet deep at mean low water below Saco, by dredging, rock removal, and use of submerged jetties. Estimated cost, \$116,500, '84, 484; '87, 456.

Projects.

The present project proposes the formation of a channel not less than 6 feet deep at mean low water to the cities of Saco and Biddeford, '87, 19.

Surveys.

Ordered by act of July 5, 1884. Made under the direction of Col. Blunt, '86, 552.

MAPS.

'86, 458.

SACRAMENTO AND FEATHER RIVERS, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 475.)

Appropriations.

1875-'79.....	\$50,000
1880.....	45,000, '80, 2236.
1881.....	60,000, '81, 2472.
1882.....	250,000, '82, 2534.
1884.....	40,000, '84, 2192.

Total 445,000

1888..... 20,000, act of August 11, 1888.

See note relating to unexpended balance, '86, 356.

SACJACAUDA CREEK. N. Y.—Continued.**Engineers.**

CHIEF OF ENGINEERS.

Report, '85, 352.

ENGINEER IN CHARGE.

Capt. E. Maguire. Report, '85, 2283.

Plans.

By Capt. Maguire, 1884, for the formation of a dredged channel 1 mile long, 100 feet wide, and 10½ feet deep. Estimated cost, \$26,000, '85, 2286.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Capt. Maguire, '85, 2283.

SACKETT'S HARBOR, N. Y.—IMPROVEMENT OF.**Appropriations.**

1882..... \$7,000, '83, 1953.

1888..... 2,000, act of August 11, 1888.

Contracts.

1883. W. J. Daly, for dredging, at 20 cents per cubic yard, '83, 1954.

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 321; '82, 314; '83, 322; '84, 326; '85, 352; '86, 346; '87, 312.

ENGINEERS IN CHARGE.

Lient. Col. W. McFarland, 1881-'83. Report, '82, 2489.

Lient. Col. H. M. Robert, 1883-'85. Reports, '83, 1953; '84, 2151.

Capt. E. Maguire, 1885-'87. Reports, '85, 2282; '86, 1894.

Capt. C. F. Palfrey, 1887-'—. Report, '87, 2391.

ASSISTANT.

M. Kingsley. Report, '82, 2490.

Operations.

1882-'83. 8,510 cubic yards material dredged from the harbor, '83, 1953.

1883-'84. 15,500 cubic yards material dredged from the harbor, '84, 2151.

1884-'85. 18-foot crib built and placed upon east end of Ship-House Point Shoal, '85, 2282.

1885-'87. No operations, '86, 1894; '87, 2391.

Projects.

In 1826 and 1828 \$6,000 was expended in clearing wrecks from the harbor, '87, 312.

By Lient. Col. McFarland, 1881, for improvement of the harbor by dredging the area to within 50 feet of the wharf-line to 12 feet deep at low water. Estimated cost, \$22,000, '82, 2490.

Modified in 1883 by a moving crib placed near end of Ship-House Point, '83, 1953; '87, 2391.

Surveys.

Ordered by act of March 3, 1881. Made, 1881, under direction of Lient. Col. McFarland, '82, 2489.

SACO RIVER, ME.—BREAKWATER AT MOUTH OF.

(Continued from Vol. I, p. 474.)

Appropriations.

1827-'79..... \$169,275

1884..... 15,000, '85, 472.

1886..... 12,500, '86, 545.

1888..... 12,500, act of August 11, 1888.

Contracts.

1884. Hamilton & Soule, for 11,000 tons of breakwater stone, '85, 471.

1-86. G. W. Andrews, for breakwater stone, '87, 454.

Engineers.

CHIEF OF ENGINEERS.

Reports, '84, 73; '85, 58; '86, 58; '87, 18.

ENGINEERS IN CHARGE.

Col. G. Thom, 1866-'85. Report, '84, 482, 483.

Col. C. E. Blunt, 1885-'86. Report, '85, 471.

Maj. J. A. Smith, 1886-'—. Reports, '86, 544; '87, 453.

SACO RIVER BREAKWATER, ME.—Continued.**Operations.**

Breakwater partially built between 1836 and 1873, '84, 483; '86, 544.

1884-'85. 3,494 tons of stone placed in breakwater, '85, 471.

1885-'86. 7,281 tons of stone placed in breakwater, '85, 544.

1886-'87. 4,475 tons of stone placed in breakwater, '87, 454.

Plans.

By Col. Thom, 1883, for repair and extension of existing breakwater and formation of dredged channel through adjacent shoals. Estimated cost, \$356,500, '84, 484; '86, 544.

Projects.

By Col. Thom, 1883, for repairs, strengthening, and raising existing breakwater. Estimated cost, \$70,000, '84, 484; '85, 471; '87, 453. Estimate increased, 1887, to \$88,840, '87, 453.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Col. Thom, '84, 483.

SACO RIVER, ME.—IMPROVEMENT OF.

(Continued from Vol. I, p. 474.)

Appropriations.

1824-'79.....	\$169,275
1886.....	12,500, '87, 458.
1888.....	10,000, act of August 11, 1888.

Contracts.

1887. T. Symonds, for rock removal, at \$10.25 per cubic yard, '87, 459. R. Hamilton, for dredging, at 23 cents per cubic yard, '87, 459.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '86, 58; '87, 19.

BOARD OF ENGINEERS.

Convened at New York April, 1887, to consider project of Maj. Smith. Report, '87, 459. (Cols. Casey and Abbot, Lieut. Col. Houston, Maj. King.)

ENGINEERS IN CHARGE.

Col. C. E. Blunt, 1884-'86. Reports, '84, 484; '86, 552, 553.

Maj. J. Smith, 1886-'— Report, '86, 546.

ASSISTANT.

C. Berrer. Report, '86, 552, 554.

Operations.

History of early operations, '87, 455.

Plans.

By Lieut. Col. Blunt, 1884, for forming and maintaining a channel 5 feet deep at mean low water below Saco, by dredging, rock removal, and use of submerged jetties. Estimated cost, \$116,500, '84, 484; '87, 456.

Projects.

The present project proposes the formation of a channel not less than 6 feet deep at mean low water to the cities of Saco and Biddeford, '87, 19.

Surveys.

Ordered by act of July 5, 1884. Made under the direction of Col. Blunt, '86, 552.

MAPS.

'86, 458.

SACRAMENTO AND FEATHER RIVERS, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 475.)

Appropriations.

1875-'79.....	\$50,000
1880.....	45,000, '80, 2236.
1881.....	60,000, '81, 2472.
1882.....	250,000, '82, 2534.
1884.....	40,000, '84, 2192.

Total 445,000

1888..... 20,000, act of August 11, 1888.

See note relating to unexpended balance, '86, 556.

SACRAMENTO AND FEATHER RIVERS, CAL.—Continued.**Commerce.**

Commerce of the river, '80, 2235.

Contracts.

1880. S. D. Stevens, for snag removal, at \$39.50 per head, '80, 2236. A. Foster, for snag removal, at \$55 per snag, '80, 2236. S. H. Davis, for snag-boat construction at \$29,774, '81, 2472. A. Hay, for barge construction, at \$11,980, '83, 1971.

Encroachments.

Injury to river from hydraulic mining, '87, 2444.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 235, 236; '81, 321; '82, 315; '83, 327; '84, 331; '85, 362; '86, 355; '87, 322.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Mendell, 1875-'85. Reports, '80, 2233; '81, 2470; '82, 2533; '83, 1969; '84, 2191.

Capt. A. H. Payson, 1885-'—. Reports, '85, 2360; '86, 1926; '87, 2441.

ASSISTANTS.

W. P. Smith. Report, '82, 2534.

Capt. C. F. Palfrey. Report, '83, 1971.

Lieut. S. W. Roessler. Report, '84, 2192.

A. Boschke. Report, '85, 2361.

Legislation.

Communications between Capt. Payson and the Attorney-General with a view to the regulation of hydraulic mining, '87, 2444.

Operations.

1879-'80. 154 snags removed from river-bed by contract, '80, 2234.

1880-'81. 336 snags removed, clearing the river from Sacramento to Colusa; 724 linear feet of wing-dam built; snag-boat built under contract, '81, 2470.

1881-'82. 1,151 snags removed; 661 trees felled; 5 wing-dams built, aggregating 950 linear feet; 2 sunken barges and 1 draw-bridge pier removed, '82, 2534, 2535.

1882-'83. 1,166 snags and 249 trees removed, '83, 1972.

1883-'84. 1,138 snags and 35 trees removed; brush wing-dam built at Moon's Island, and repairs made on Call's Bend Dam, '84, 2191.

1884-'85. 1,322 snags and 754 trees removed; dams strengthened at Parrott's Chute and Call's Bend; bridge-pier removed, '85, 2360.

1885-'86. 650 snags and 139 trees removed, and as much dam-building done as stage of water rendered possible, '86, 1926.

1886-'87. 1,029 snags removed and 250 trees cut down; dredge built by contract, '87, 2442, 2443.

Physical Characteristics.

Of upper river, '80, 2237.

Projects.

The project of Lieut. Col. Mendell, 1874, for improvement of Sacramento and Feather rivers, proposed snag removal and wing-dam construction, was continued throughout. The amount appropriated from 1880 to 1886 for this work was \$445,000. The improvement was made to include, in 1880, the Upper Sacramento for 100 miles above Colusa. The projects have for their object the temporary improvement of the low-water channel, and consist of snagging, dam construction, and bar-scraping, carried on by hired labor and the United States snag-boat, '75, ii, 700; '80, 2234; '86, 1926.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Mendell, '80, 2237.

MAPS.

'86, 1927.

SAGINAW RIVER, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 477.)

Appropriations.

1866-'79	\$195,000
1880	15,000, '80, 2043.
1881	10,000, '81, 2250.
1882	125,000, '82, 2333.

SAGINAW RIVER, MICH.—Continued.**Appropriations—Continued.**

1884.....	\$50,000, '84, 2043.
1886.....	33,750, '86, 1828.
Total	428,750
1888.....	65,000, act of August 11, 1888.

Commerce.

Value of improvement, '84, 2043.

Contracts.

1879. E. H. French, for dredging, at 11 cents per cubic yard, '80, 2043.
 1880. T. M. Hubbell, for dredging, at \$16 per hour, '81, 2250.
 1881. G. Talbot, for dredging, at 60 cents per cubic yard, '81, 2250.
 1883. C. Southerland, for dredging, at 25 cents per cubic yard, '83, 1862. Carkin, Stickney & Cram, for dredging, at 37½ cents per cubic yard, '83, 1862.
 1884. Carkin, Stickney & Cram, for dredging, at 27½ cents per cubic yard, '85, 2138. L. P. & J. A. Smith, for dredging, at 23 cents per cubic yard, '85, 2138. Carkin, Stickney & Cram, for dredging, at 38 cents per cubic yard, '85, 2138.
 1886. Carkin, Stickney & Cram, for dredging, at 34 cents and 44 cents per cubic yard. O. J. Quinn, for pile work. Durcharme, Fletcher & Co., for iron. Hickler, Green & Co., for dredging, at 34 and 44 cents per cubic yard. J. W. Owen, for timber, '86, 1826.
 1887. Hubble & Skeldon, for dredging, at 30 cents per cubic yard, '87, 2251-2254.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 220; '81, 298; '82, 293; '83, 302, 1863; '84, 304; '85, 327; '86, 322; '87, 239.

BOARD OF ENGINEERS.

Convened at Detroit, Mich., October 19, 1882, by S. O. No. 82, to report upon project for improvement of Saginaw River. Report, '83, 1863. (Majors Robert, Farquhar, and Henp.)

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1877-'82. Reports, '80, 2040; '81, 2248; '82, 2331.
 Maj. F. U. Farquhar, 1882-'83, '83, 1835.
 Lieut. Col. O. M. Poe, 1883-'— Reports, '83, 1858; '84, 2041; '85, 2138; '86, 1826; '87, 2250.

ASSISTANTS.

H. Kallman. Report, '84, 2044.
 B. H. Muehle. Report, '85, 2140.

Operations.

- 1879-'80. 46,629 cubic yards sand dredged from channel, '80, 2041.
 1880-'81. Repair of Carrollton Bar training-wall commenced; sand barrier at tail of Carrollton Bar dredged through, and dredging commenced under Talbot contract, '81, 2249.
 1881-'82. In the upper river: Carrollton Bar revetment completed and channel restored; plank-beam wall built up: revetment and Zilwaukee Wing-dam repaired. In lower river: 11,019 cubic yards material dredged, '82, 2332, 2333.
 1882-'83. 14,160 cubic yards material dredged in vicinity of Bay City and at mouth of river, '83, 1859.
 1883-'84. 247,185 cubic yards material dredged from river mouth and vicinity of Bay City, '84, 2042.
 1884-'85. 97,410 cubic yards material dredged in vicinity of Bay City and at mouth of river, '85, 2138.
 1885-'86. 16,200 cubic yards material dredged from mouth of Saginaw River, '86, 1826.
 1886-'87. 5,998 cubic yards material dredged, and repairs made to Carrollton revetment, '87, 2252.

Projects.

- The project of 1866 proposed the formation, by dredging, of a channel 12 feet deep through the bar off the river's mouth, '66, iv, 59-61; '67, 146; '68, 141.
 In 1874 Maj. Weitzel proposed the removal of Carrollton and other bars in vicinity of East Saginaw by dredging and confining the channel by a pile revetment, '74, i, 205-209; '75, i, 274.
 In 1881 Maj. Harwood proposed at and below Bay City securing 14 feet depth in that portion of the channel in front of Bay City, and restoring and deepening the channel of entrance from Saginaw Bay to 14 feet, '81, 2250.
 Total amount appropriated from 1866 to 1882, \$220,000.

SAGINAW RIVER, MICH.—Continued.**Projects—Continued.**

By Board of Engineers, 1892, for removal of snags, logs, and store-booms projecting into the channel; for excavation of a channel 12 feet deep and 200 feet wide between the junction of Tittabawassee and Shiawassee rivers and Portsmouth Bridge at Bay City; for excavation of a channel 11 feet deep and 200 feet wide through shoals in vicinity of Bay City, and across bar at mouth of river. Estimated cost, \$446,000, '83, 1868, 1867; '84, 2041.

Amount appropriated from 1882 to 1886, inclusive, \$208,750. Amount estimated to complete project, \$337,250, '86, 1828.

Surveys.

Resurvey of upper river, 1881, '82, 2332.

Maps.

'84, 2042; '85, 2150.

SAINT ANTHONY, MINN.—PRESERVATION OF FALLS OF.

(See MISSISSIPPI RIVER, PRESERVATION OF FALLS OF SAINT ANTHONY.)

SAINT AUGUSTINE CREEK, GA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 479.)

Appropriations.

1879..... \$5,000.

Contracts.

1880. J. G. Smith, for partial removal of sunken dry-dock, at \$1,500, '80, 958.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 129; '81, 174; '82, 175; '83, 185; '84, 186; '85, 186; '86, 185; '87, 148.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1875—'. Reports, '80, 957; '81, 1105; '82, 1202; '83, 954; '84, 1111; '85, 1214; '86, 1102; '87, 1174.

Operations.

1880-'81. Partial removal of sunken dry-dock effected under appropriations of 1879, '81, 1105.

No necessity for further operations, '87, 1174.

Projects.

By Lieut. Col. Gillmore, 1875, for removal of sunken timber dry-dock for channel entrance to a depth of 10 feet at mean low water. Estimated cost, \$5,000, '75, ii, 37; '77, 381; '80, 957. Accomplished in 1880-'81, '81, 1105.

SAINT AUGUSTINE HARBOR, FLA.—EXAMINATION OF.

[\$35,000 appropriated by act of August 11, 1883.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 199; '87, 162.

ENGINEER IN CHARGE.

Capt. W. T. Rossell. Report, '85, 1282.

ASSISTANT.

A. W. Barber. Report, '85, 1283.

Plans.

In 1884 Capt. Rossell considered that the harbor was ample for the existing requirements of commerce, '85, 1282.

Surveys.

Examinations ordered by act of July 5, 1884. Made under direction of Capt. Rossell, '85, 1282; '87, 162.

Examination ordered by act of August 5, 1886, '87, 162.

SAINT CHARLES, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**SAINT CLAIR FLATS SHIP CANAL, MICH.—IMPROVEMENT, OPERATION, AND MAINTENANCE OF.**

(Continued from Vol. I, p. 479.)

Appropriations.

1852-'79	\$653,560.00
1880	2,500.00, '80, 2049.
1882, allotment	9,889.60, '82, 2340.
1883, allotment	5,000.00, '83, 1877.
1886	18,750.00, '86, 325.

Total..... 689,699.60

1888..... 75,000.00, act of August 11, 1888.

Commerce.

Importance of the improvement, '84, 2071.

Contracts.

1882. A. J. Dupiers, for construction of ice-harbor, '83, 1878.

1884. Chandler Brothers, for repairs to revetment, '85, 2162.

1885. E. H. French, for dredging, at 11½ cents per cubic yard, '86, 1839.

1886. A. J. Dupiers, for reconstruction of canal revetment, '87, 2263.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 221; '81, 300; '82, 295; '83, 304; '84, 306; '85, 329; '86, 324, 325; '87, 291, 292.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1877-'82. Reports, '80, 2047; '81, 2255; '82, 2339.

Maj. F. U. Farquhar, 1883. Report, '83, 1878.

Lieut. Col. O. M. Poe, 1883-'—. Reports, '83, 1876; '84, 2071, 2072; '85, 2159, 2160; '86, 1837, 1838; '87, 2262, 2264.

Operations.

1829-'80. 3,626 cubic yards dredged from shoal in canal, '80, 2047.

1880-'81. Operations and maintenance, '81, 2255.

1881-'82. Minor repairs of revetment, '82, 2339.

1882-'83. Minor repairs to revetment and construction of ice-breaker, '83, 1876.

1883-'84. Minor repairs of revetment, '84, 2072.

1884-'85. Minor repairs of revetment and 4,252 cubic yards dredged from channel, '85, 2161.

1885-'86. Minor repairs to revetment and 60,298 cubic yards dredged from channel, '86, 1839.

1886-'87. Comprehensive repairs of the revetment in progress, '87, 2263. Care and operation of canal, '87, 2264.

Private and Corporate Work.

\$20,000 appropriated for dredging the South Pass by the Canadian authorities, '66, iv, 54.

Projects.

The project of 1866 and 1872 proposed the formation of a channel 200 feet wide, 16 feet deep, and 7,221 feet long, protected on each side by revetment. Estimated cost, \$423,754, '66, iv, 57; '67, 28; '72, 216. The canal was completed in 1875, '75, i, 52, 280. Statement of cost of the work, '83, 1878.

By Maj. Farquhar, in 1883, for rebuilding revetment, at an estimated cost of \$132,908, '83, 1877, 1879, 1880; '84, 306.

By Col. Poe, in 1885, for rebuilding the revetment, at an estimated cost of \$153,300, '85, 2160; '86, 1838. Increased to \$200,000 in 1887, '87, 2263.

SAINT CLAIR RIVER, MICH.—SURVEYS OF RIGHT BANK FROM LAKE HURON TO LAKE SAINT CLAIR AND BAR OPPOSITE SAINT CLAIR CITY.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '85, 332; '87, 294.

ENGINEER IN CHARGE.

Lieut. Col. O. M. Poe. Reports, '85, 2197, 2203; '87, 2270.

SAINT CLAIR RIVER, MICH.—Continued.**Engineers—Continued.****ASSISTANTS.**

B. H. Muehle. Report, '85, 2204.

O. B. Wheeler. Report, '85, 2199.

Physical Characteristics.

Description of locality, '85, 2199, 2205.

Erosion of right bank, '85, 2198, 2200.

Plans.

In 1884 Col. Poe did not consider that the bank erosion was prejudicial to the river channels, '85, 2198, 2202.

By Col. Poe, 1886, for the removal of the shoal opposite Saint Clair City to a depth of 17 feet. Estimated cost, \$40,000, '87, 2270.

Surveys.

Of right bank ordered by act of July 5, 1884. Made under direction of Col. Poe, '85, 2197, 2203.

Of bar opposite Saint Clair City ordered by act of August 5, 1886. Made under direction of Col. Poe, '87, 2270.

SAINT CROIX RIVER, ME.—CONSTRUCTION OF BREAKWATER AT CALAIS.**Appropriation.**

1881..... \$4,000, '81, 458.

Contracts.

1881. With A. Towers, for rebuilding breakwater cribs, '81, 457.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 63; '82, 63.

ENGINEER IN CHARGE.

Col. G. Thom, 1881-'82. Report, '81, 457.

Operations.

Breakwater built in 1856, '81, 457.

1881-'82. Breakwater consisting of 3 cribs rebuilt, '82, 486.

Projects.

In 1856 3 crib-piers filled with stone were built upon the ledge; their object was to prevent vessels from drifting upon the ledge. The work having been nearly destroyed by freshets and ice in 1881, they were rebuilt at a cost of about \$4,000, '82, 63, 486.

SAINT CROIX RIVER, ME.—SURVEY OF, FROM CALAIS TO BREAKWATER LEDGE.

(Continued from Vol. I, p. 462.)

Commerce.

Commercial statistics, '87, 478.

Encroachments.

Injury to river from mill refuse, '87, 479, 480.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 22.

ENGINEERS IN CHARGE.

Lieut. Col. G. Thom. Report, '67, 503.

Maj. J. A. Smith. Report, '87, 477.

Plans.

By Col. Thom, 1875, for the formation of a dredged channel 200 feet wide and 9 feet deep at mean low water to Todd's Ledge, and from thence to the toll-bridge 100 feet wide. Estimated cost, \$200,000, '75, ii, 382; '87, 480. Improvement not recommended until provision is made for the proper disposal of mill-waste, '87, 481.

Surveys.

Ordered by act of August 5, 1886. Made under the direction of Maj. Smith, '87, 477.

SAINT CROIX RIVER, WIS. AND MINN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 483.)

Appropriations.

1878-'79	\$18,000
1880.....	10,000, '80, 1581.
1881.....	8,000, '81, 1752.
1882.....	30,000, '82, 1815.
1884.....	9,000, '84, 1608.
1886.....	7,500, '86, 1493.

Total 82,500

1888..... 10,000, act of August 11, 1888.

Statement of appropriations, '87, 1708.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 180; '81, 243; '82, 238; '83, 246; '84, 247; '85, 269; '86, 259; '87, 227.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878-'—. Reports, '80, 1580, 1601, 1661; '81, 1751; '82, 1813, 1816; '83, 1444; '84, 1606; '85, 1738; '86, 1490; '87, 1705.

ASSISTANT.

V. D. Simar. Report, '80, 1615.

Operations.

1879-'80. 520 snags, 377 stumps and trees, 41 cubic yards bowlders, and 4 cribs removed; 1,100 cubic yards brush and 2,562 cubic yards stone placed; 1,000 linear feet of stone graded and revetted, and 575 linear feet of dams built, '80, 1580.

1880-'81. 636 snags, 380 logs, stumps, and trees, 69 cubic yards rock, 8 piles and 1 crib removed; 3,231 cubic yards rock and 868 cords brush placed in 1,500 linear feet dam and revetment, '81, 1751.

1881-'82. 173 stumps, snags, and trees removed; 3,314 cubic yards rock and 2,896 cords brush placed in 3,300 linear feet of dam and revetment; 997 linear feet of old revetment repaired, '82, 1814.

1882-'83. 1,777 linear feet of dam and 1,379 linear feet of shore protection built, and 87 snags, 313 stumps, 6 cribs, and 1 wreck removed; pile and sheet dam commenced at Catfish Bar, and 1,500 cubic yards gravel removed from same place, '83, 1444, 1445.

1883-'84. 260 snags, 227 stumps, trees, and logs, and 156 cubic yards material removed; work on pile and brush training-dam at Hudson Bar continued; 9,000 cubic yards material dredged from Catfish and Hudson bars, '84, 1607.

1884-'85. 133 sunken logs removed from channel; 1,000 linear feet of pile-dam at Hudson strengthened; 3,900 cubic yards gravel removed from Catfish Bar, '85, 1739.

1885-'86. Dam at Hudson Bar extended 165 feet and furnished with brush and stone protection; 3,000 cubic yards material dredged from channel, '86, 1491.

1886-'87. 6,694 cubic yards material dredged from Hudson and Catfish bars; 1,105 linear feet of dam and 250 linear feet of jetty built, '87, 1706. Statement of past operations '87, 1705, 1706.

Projects.

By Maj. Farquhar, 1874, for the improvement of the river below Saint Croix Falls, the construction of wing-dams, removal of boom-piers, snags, and overhanging trees, so as to give a low-water depth of 3 feet. Estimated cost, \$21,758, '75, i, 375; '78, 100; '79, 1182.

Surveys.

Of river from Taylor's Falls to Prescott, 1880, '80, 1661.

Survey of headwaters of Saint Croix in connection with reservoirs on headwaters of Mississippi River, '80, 1601-1624.

MAPS.

'87, 1706.

SAINT FRANCIS RIVER, ARK. AND MO.—IMPROVEMENT OF.

(See also WHITE AND SAINT FRANCIS RIVERS.)

(Continued from Vol. I, p. 483.)

Appropriations.

1880. Between Wittsburgh and Lester Landing..	\$5,000, '80, 1315.
1884. Saint Francis River.....	12,000, '85, 1597.
1886. Saint Francis River.....	8,000, '86, 1384.

total 25,000

SAINT FRANCIS RIVER, ARK. AND MO.—Continued.**Appropriations—Continued.**

1839. { Saint Francis River, Ark. \$4,000 } act of August 11, 1838.
 { Saint Francis River, Mo. 5,000 }

Commerce.

Value of improvement, '86, 1383, 1385; '87, 1541.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 154, 158; '81, 213, 217; '85, 249; '86, 242; '87, 209, 210.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1879-'82. Reports, '80, 1315; '81, 1434, 1481.

Capt. T. H. Haudbury, 1881. Report, '81, 1513.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1596; '86, 1382; '87, 1539, 1549.

ASSISTANT.

J. B. Roherer. Report, '81, 1482.

Operations.

1880-'81. 2,949 logs, snags, and trees removed, '81, 1434.

1884-'85. Construction of snag-boat and removal of 849 snags and trees, '85, 1596.

1885-'86. Snaging operations continued, '86, 1383.

1886-'87. 189 snags removed, '87, 1540.

Plans.

By Maj. Benyaard, 1880, to secure a low-water navigation in the Saint Francis from Greenville to Cairo, Arkansas and Texas Railroad, by removal of snags, etc., and construction of low-water dams. Estimated cost, \$24,426. Col. Simpson reports that commerce would not justify the above expenditure, in which opinion Maj. Benyaard concurs, '81, 1482, 1484.

In 1887 Capt. Taber considered the reach of river from Greenville to the Arkansas State line worthy of improvement, by the removal of snags and similar obstructions, at an estimated cost of \$7,300, '87, 1550.

Projects.

By Maj. Benyaard, 1880, for improvement of the river between Wittsburgh and Lester Landing, by cutting and marking a channel through the Lake region, removing snags and similar obstructions from the bed and banks of the stream. No estimate was made for completion of this project and only an appropriation of \$5,000 was made in 1880, '80, 1315; '81, 1434.

Surveys.

From Greenville, Mo., to the Cairo, Arkansas and Texas Railroad, ordered by act of June 14, 1880. Made, 1881, under direction of Maj. Benyaard, '81, 1481.

From Greenville to State Line ordered by act of August 5, 1886. Made under direction of Capt. Taber, '87, 1549.

SAINT GEORGE'S RIVER, ME.—EXAMINATION FROM WARREN TO THOMASTON.**Encroachments.**

Bridges without draws, '87, 474.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 21.

ENGINEER IN CHARGE.

Maj. J. A. Smith. Report, '87, 473.

Plans.

In 1886 Maj. Smith did not consider the existing demands of commerce would justify the improvement of river, '87, 475.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Maj. Smith, '87, 473.

SAINT JEROME'S CREEK, MD.—IMPROVEMENT OF.**Appropriations.**

1881..... \$6,500, '81, 153.
 1882..... 5,000, '82, 1017.
 1884..... 15,000, '84, 985.

SAINT JEROME'S CREEK, MD.—Continued.**Contracts.**

1881. T. P. Morgan, for dredging, at 35 cents per cubic yard for inner channel and 15 cents per cubic yard for outer channel, '81, 956.
 1882. T. P. Morgan, for dredging, at 35 cents per cubic yard, '82, 1015.
 1883. D. Constantine, for dredging, at 25 cents per cubic yard, '83, 801. G. E. Ward, for dredging, '84, 984.
 1884. J. Caler & Sons, for dredging, at 13 cents per cubic yard, '85, 969.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 153; '82, 148; '83, 154; '84, 156; '85, 146; '86, 141; '87, 108.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1880-'81. Report, '81, 935.

S. T. Abert, U. S. Agent, 1881-'— . Reports, '81, 955; '82, 1015; '83, 800; '84, 984; '85, 968; '86, 904; '87, 983.

ASSISTANT.

W. R. Hutton. Report, '81, 935.

Operations.

History of operations, '85, 1015.

1880-'81. 90,092 cubic yards dredged from inner channel, '81, 957.

1881-'82. 22,320 cubic yards material dredged from the outer end of the inner channel, '82, 1016.

1882-'83. 15,526 cubic yards material dredged from Cuts "A" and "B," '83, 802.

1883-'84. 4,151 cubic yards material dredged from continuation of Upper Pond channel, '84, 984.

1884-'85. 51,954 cubic yards material dredged from channel, '85, 969.

1885-'86. 11,106 cubic yards material dredged from channel, '86, 905.

1886-'87. 500 cubic yards material dredged from channel, '87, 934.

Private and Corporate Work.

Channel to Upper Pond dredged by U. S. Fish Commission, '84, 984.

Projects.

By S. T. Abert, 1880, for excavation of a channel 100 feet wide and 9 feet deep through the bar at the mouth of Saint Jerome's Creek and a channel 40 feet wide and 6 feet deep into the south fork of the same, the material to be formed into dike inclosing a part of the south fork for a pond for the U. S. Fish Commission. Estimated cost, \$21,500.

From 1881 to 1886, inclusive, \$26,500 had been appropriated, when the amount to complete project was estimated at \$26,000, '85, 970; '87, 934.

Surveys.

Ordered by act of December 13, 1880. Made under direction of Lieut. Col. Craighill, '81, 935.

MAPS.

'86, 904.

SAINT JOHN'S RIVER, at Big Rapids, ME.—EXAMINATION OF.**Commerce.**

Flat boat navigation, '87, 472.

Engineers.**CHIEF OF ENGINEERS.**

Report, '87, 21.

ENGINEER IN CHARGE.

Maj. J. A. Smith, 1886. Report, '87, 471.

Plans.

Maj. Smith reports the locality as unworthy of improvement in view of the cost and the slight commerce, '87, 473.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Smith, '87, 471.

SAINT JOHN'S RIVER (UPPER), FLA.—IMPROVEMENT OF.**Appropriations.**

1884..... \$5,000, '84, 1138.

SAINT JOHN'S RIVER (UPPER), FLA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '84, 193; '85, 193; '86, 191; '87, 156.

ENGINEERS IN CHARGE.

Lieut. Col. Q. A. Gillmore, 1884-'85. Report, '84, 1137.

Capt. W. T. Rossell, 1885-'86. Report, '85, 1253.

Capt. W. M. Black, 1886-'— Reports, '86, 1133; '87, 1219.

Operations.

Deferred for further appropriations, '87, 156.

Projects.

By Lieut. Col. Gillmore, 1884, for improvement of the Upper Saint John's River for a channel width of 100 feet and depth of 6 feet, by excavation of curved cut-offs, dredging, and the construction of closure dams. Estimated cost, \$38,800, '84, 1137; '87, 1220.

SAINT JOHN'S RIVER, FLA., between Lake George and Lake Munroe—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 194.

ENGINEERS IN CHARGE.

Capt. J. C. Post. Report, '84, 1138.

Col. Q. A. Gillmore. Report, '84, 1140.

ASSISTANT.

Lieut. W. T. Rossell. Report, '84, 1139.

Plans.

By Col. Gillmore, 1883, for a low-water channel depth of 6 feet at bends by formation of straight cut-offs. Estimated cost, \$43,000, '84, 1142.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Col. Gillmore, '84, 1138, 1140.

SAINT JOHN'S RIVER, FLA. AND CHARLOTTE HARBOR, GULF OF MEXICO—SHIP CANAL BETWEEN.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 179; '82, 175.

ENGINEER IN CHARGE.

Lieut. Col. Q. A. Gillmore. Report, '82, 1204.

ASSISTANT.

W. G. Williamson. Report, '82, 1219.

Plans.

By Col. Gillmore, 1882, for a steam-boat route, with locks, from the Saint John's River to Peace Creek or Charlotte Harbor, via Tohopokeliga Lake; canal 40 feet wide at bottom and 5 feet deep; locks 25 feet wide and 125 feet long; with the necessary improvement of the natural channels of Saint John's River and Peace Creek. Estimated cost, \$5,662,812, '82, 1204, 1213, 1216.

Surveys.

Ordered by act of June 14, 1880, '82, 1204. Made under direction of Col. Gillmore, 1882, '82, 1204.

SAINT JOHN'S RIVER, FLA.—IMPROVEMENT OF BAR AT MOUTH.

(Continued from Vol. I, p. 483.)

Appropriations.

1852-'79	\$87,000
1880	125,000, '80, 971.
1881	100,000, '81, 1132.
1882	150,000, '82, 1195.

SAINT JOHN'S RIVER, FLA.—Continued.**Appropriations—Continued.**

1884..... \$150,000, '84, 1132.
 1886..... 150,000, '86, 1130.

Total..... 762,000

1888. From Jacksonville to ocean... 175,000, act of August 11, 1888.

Commerce.

Benefit of improvement, '81, 1130, 1131.

Contracts.

1880. Lara Ross & Co., for jetty construction, '81, 1132.

1881. J. H. Durkee, for jetty construction, '81, 1133.

1882. A. A. Howlett, for jetty construction, '83, 946.

1885. A. A. Howlett, for jetty construction, '85, 1250.

1886. J. A. Bryan, for dike construction at \$7.22 per linear foot, '87, 1210. R. Moore, for mattress and stone, at 45 cents and \$2.45 per square yard and ton, '87, 1215.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 131; '81, 178; '82, 173; '83, 183; '84, 190; '85, 191; '86, 190; '87, 154.

ENGINEERS IN CHARGE.

Col. Q. A. Gillmore, 1869-'85. Reports, '80, 970; '81, 1127; '82, 1189; '83, 940; '84, 1126.

Capt. W. T. Rossell, 1885-'86. Report, '85, 1243.

Capt. W. M. Black, 1886-'— . Reports, '86, 1125; '87, 1207.

ASSISTANTS.

Lieut. W. L. Fisk. Report, '81, 1133.

Capt. J. C. Post. Report, '82, 1195.

Lieut. W. T. Rossell. Reports, '83, 946; '84, 1132.

Capt. J. C. Post. (Special Report), '83, 949.

Operations.

1880-'81. Work commenced by partial construction of 2,786 feet of south jetty, '81, 1128.

1881-'82. Apron foundation of south jetty extended 2,027 feet and portions of 2d, 3d, 4th, and 5th courses laid; 8 spur jetties built from south jetty averaging 90 feet in length; 1,115 feet of north jetty foundation course laid, '82, 1191, 1192.

1882-'83. Original foundation course of south jetty enlarged by 2,113 linear feet of mattress revetment; jetty raised by additional stone and mattress courses aggregating 2,119 feet; 13,100 cubic yards riprap deposited on jetty, '83, 944.

1883-'84. 1,950 linear feet of apron mattress laid on north side of south jetty, and south side revetment extended 400 feet, '84, 1128.

1884-'85. 16,312 cubic yards of stone and 52,037 square yards of mattress placed in south jetty; 3,699 cubic yards of stone and 16,712 square yards of mattress placed in north jetty, '85, 1247.

1885-'86. 1,339 linear feet of mattress work placed in line of jetty and ballasted with 3,910 cubic yards of stone, '86, 1127.

1886-'87. 11,265 tons of stone and 16,470 square yards of brush mattress used in dike and jetty construction, '87, 1209-1212.

Projects.

By Lieut. Col. Gillmore, 1879, for jetties at mouth of Saint John's River, the north jetty to be 5,400 feet long with its inner end on Fort George's Island; the south jetty to be 6,800 feet in length, with inner end on mainland below General's Mound; width between jetties 1,600 feet; both jetties to be submerged from shore to a point 2,000 feet from sea-ends, the rest at the level of half tide, the jetties to extend to the 16-foot curve and to produce a mid-channel depth of from 15 to 16 feet at mean low water. Estimated cost, \$1,306,409, '79, 784, 785; '80, 970; '87, 1208.

Surveys.**MAPS.**

'81, 1132; '83, 946; '84, 1132; '85, 1250; '86, 1128; '87, 1214.

SAINT JOHN'S RIVER AND FERNANDINA, FLA., inside passage between—IMPROVEMENT OF.

(Continued from Vol. I, p. 483.)

Appropriation.

1880..... \$7,000, '80, 968.

Statement of appropriations previous to 1880, '82, 1203.

SAINT JOHN'S RIVER AND FERNANDINA, FLA.—Continued.**Contracts.**

1879. J. S. Lawrence, for dredging, at 15 cents per cubic yard, '80, 967.
 1881. J. A. Clond, for dredging, at 26 cents per cubic yard, '81, 1126.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 131; '81, 177; '82, 175; '83, 185; '84, 190; '85, 191; '86, 190; '87, 153.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1869-'— Reports, '80, 966; '81, 1125; '82, 1203; '83, 954; '84, 1125; '85, 1234; '86, 1124; '87, 1199.

ASSISTANTS.

S. L. Fremont. Report, '80, 965.
 Lieut. W. L. Fisk. Report, '81, 1127.

Operations.

1879-'80. 38,763 cubic yards material dredged, '80, 967.

1880-'81. 8,684 cubic yards material dredged, '81, 1126.

1881-'87. Operations discontinued, because there seemed no urgent need for its continuance and no prospect of permanency, '86, 190; '87, 1199.

Projects.

By Col. Gillmore, 1875, for improvement of inside passage from Saint John's River to Fernandina by a channel 80 feet wide and 11 feet deep at high water. Estimated cost, \$160,000, '75, ii, 59; '79, 98. Operations discontinued in 1881, '86, 190.

SAINT JOHN'S RIVER TO JUPITER INLET, FLA.—EXAMINATION FOR CANAL BETWEEN.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 199.

ENGINEER IN CHARGE.

Capt. W. T. Russell. Report, '85, 1291.

ASSISTANT.

A. W. Barber. Report, '85, 1293.

Plans.

Capt. Russell, in 1884, considered the route worthy of improvement and recommended surveys, '85, 1292.

Surveys.

Ordered by act of July 5, 1884, '85, 199. Examination made by Capt. Russell in 1884, '85, 1291.

SAINT JONES RIVER, DEL.—IMPROVEMENT OF.**Appropriations.**

1881..... \$5,000, '81, 799.
 1884..... 10,000, '84, 835.
 1886..... 10,000, '86, 861.
 1888..... 15,000, act of August 11, 1888.
 Statement of appropriations, '87, 833.

Contracts.

1884. T. Draper, for dredging, at 15 cents per cubic yard, '85, 877.

1886. American Dredging Company, at 12 cents per cubic yard, '87, 832.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 98; '81, 126, 129; '82, 124; '83, 125; '84, 133; '85, 129; '86, 127; '87, 89.

ENGINEERS IN CHARGE.

Col. J. N. Maccomb, 1880-'82. Report, '81, 799.

Capt. W. Ludlow, 1882-'83. Report, '82, 779.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 636.

Maj. W. H. Heuer, 1884-'85. Report, '84, 835.

W. F. Smith, U. S. Agent, 1885-'— Reports, '85, 877; '86, 860; '87, 831.

SAINT JONES RIVER, DEL.—Continued.**Engineers—Continued.****ASSISTANTS.**

Capt. W. Ludlow. Report, '81, 800.

W. S. Edwards. Report, '81, 802.

J. N. Odiorne. Report, '83, 638.

J. M. Stewart. Report, '84, 835.

Operations.

1884-'85. Work of deepening and straightening the channel commenced, '85, 877.

1885-'86. 54,128 cubic yards material dredged from Cherry Bend and Dover Cut-offs and at Cypress Point and Broad Reach Shoal, '86, 861.

1886-'87. 55,838 cubic yards material dredged from the channel, '87, 832.

Physical Characteristics.

Description of river, '81, 801.

Projects.

By Col. Macomb, 1881, for excavation of a channel through the bar at the river's mouth and at other points to a depth of 3 feet at mean low water with a width of channel from 200 to 250 feet; also for construction of 3,300 linear feet of jetty at entrance. Estimated cost, \$35,000, '81, 799, 801; '87, 831.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Macomb, '81, 801.

SAINT JOSEPH'S HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 485.)

Appropriations.

1836-'79	\$280, 113
1880	8, 000, '80, 2032.
1881	10, 000, '81, 2239.
1882	12, 000, '82, 2321.
1884	15, 000, '84, 1994.
1886	10, 000, '86, 1772.

Total	335, 113
-------------	----------

1888	12, 000, act of August 11, 1888.
------------	----------------------------------

Contracts.

1879. Dewar & Corlett, for pier extension, '80, 2032.

1886. Deming & Oliver, for materials for scow construction, '86, 1773. Leathern & Smith, for plank; S. D. Kimbark, for iron; T. W. Kirby, for stone; A. H. Petries, for pine timber, and J. M. Allmendinger, for piles, '87, 2201.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 218; '81, 296; '82, 291; '83, 298; '84, 300; '85, 321; '86, 316; '87, 284.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1880-'82. Reports, '80, 2030; '81, 2238.

Maj. D. P. Heap, 1882-'83. Report, '82, 2318.

Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1832; '84, 1993; '85, 2086; '86, 1771; '87, 2200.

Operations.

1879-'80. Pier extension under Gere's contract completed; dredging on outer bar completed; wing-dam completed at mouth of Benton Harbor Canal, '80, 2030.

1880-'81. North pier extended 50 feet; 27,137 cubic yards dredged in Benton Harbor Channel, '81, 2238.

1881-'82. No operations at Saint Joseph's Harbor; deepening and revetting Benton Harbor Channel commenced, '82, 2320.

1882-'83. 180 linear feet of south pier repaired and refilled, 700 linear feet of sand fence built on north side of channel, and 760 on south side, '83, 1832.

1883-'85. No operations, '84, 1994; '85, 2086.

1885-'86. Breaks in the north pier repaired, '86, 1771.

1886-'87. Repairs to pile revetment and plant, and renewal of south pier superstructure commenced, '87, 2200.

Projects.

For projects previous to 1886, see Vol. I, page 487, Index to Reports of the Chief of Engineers.

SAINT JOSEPH'S HARBOR, MICH.—Continued.**Projects—Continued.**

From 1836 to 1865, inclusive, \$156,113 was appropriated, '66, iii, 35. The projects of 1866 and 1874 proposed the formation of a channel of entrance not less than 16 feet deep, '66, iv, 111, 112; '75, i, 265; '76, ii, 518.

In 1880 the project was modified by the improvement of Benton Harbor Channel to a depth of 12 feet, together with the revetment of the north bank for a distance of 2,500 feet, '80, 2031.

From 1866 to 1886, inclusive, \$179,000 was appropriated, when it was estimated that \$41,015 would be required to complete project, '86, 316; '87, 2201.

Surveys.**MAPS.**

'82, 2318, 2320; '83, 1832.

SAINT JOSEPH, MO. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**SAINT JOSEPH'S RIVER, IDAHO. (See CŒUR D'ALENE LAKE AND RIVER, IDAHO.)****SAINT JOSEPH'S RIVER, MICH.—SURVEY OF.**

[\$2,500 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 221.

ENGINEER IN CHARGE.

Maj. F. Harwood, 1879. Report, '80, 2049.

ASSISTANT.

J. A. Mitchell. Report, '80, 2050.

Physical Characteristics.

Description of river, '80, 2051.

Plans.

By Maj. Harwood, 1880, for improvement of Saint Joseph's River between Saint Joseph and Berrien Springs, a distance of 15 miles, so as to give a 4-foot slack-water navigation, by construction of 8 dams and 11 locks with the elevation of bridges, and raising dams at South Bend and Mishawaka. Estimated cost, \$634,331.

Maj. Harwood considers cost of improvement not commensurate with commerce to be benefited, '80, 2054.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Harwood, '80, 2049.

SAINT LAWRENCE RIVER—EFFECT OF DEEPENING CHANNEL AT GALLOP'S RAPIDS.**Engineers.****CHIEF OF ENGINEERS.**

Report, '82, 314.

ENGINEERS IN CHARGE.

Lieut. Col. Comstock and Maj. McFarland. Report, '82, 2470-2489.

SAINT LOUIS BAY AND RIVER, WIS. (See SUPERIOR BAY.)

SAINT LOUIS, MO. (See MISSISSIPPI RIVER BETWEEN THE MOUTHS OF THE ILLINOIS AND OHIO RIVERS; ALSO SAINT LOUIS, ICE-HARBOR AT.)

SAINT LOUIS, MO.—ICE-HARBOR AT.

(Continued from Vol. I, p. 488.)

Appropriations.

1880..... \$50,000, '80, 1391.
1881..... 10,000, '81, 1574.

The act of August 2, 1882, provides for the transfer of these appropriations to the improvement of the Mississippi River opposite Saint Louis, '82, 1648.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 160; '81, 222, 1574; '82, 220.

BOARD OF ENGINEERS.

Convened at New York September 30, 1880, to report upon necessity for and location of ice-harbor according to project of Capt. Ernst, '81, 1576-1582. Board are doubtful as to necessity of ice-harbor at locality, '81, 1575, 1577, 1583. (Cols. Tower, Newton, and Lieut. Col. Abbot.)

ENGINEER IN CHARGE:

Maj. O. H. Ernst, 1880. Reports, '80, 1390; '81, 1573, 1578, 1582; '82, 1648.

Plans.

By Maj. Ernst, 1880, for formation of ice-harbor at Cahokia Chute, east of Arsenal Island, by construction of levees, dams, and jetties. Estimated cost, \$182,000, '81, 1581, 1582.

Inexpediency of an ice-harbor at locality proposed, '81, 1575, 1577, 1583.

SAINT MARK'S RIVER, FLA.—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 206.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '84, 1222.

ASSISTANT.

Lieut. J. L. Lusk. Report, '84, 1222.

Plans.

In 1883 Capt. Damrell considered that the existing channel was sufficiently good for the present requirements of commerce, '84, 1222.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Damrell, '84, 1222.

SAINT MARY'S RIVER, OHIO—EXAMINATION OF.

Engineers.

CHIEF OF ENGINEERS.

Report, '81, 314.

ENGINEER IN CHARGE.

Maj. J. M. Wilson. Report, '81, 2343.

Physical Characteristics.

River described, '81, 2345.

Plans.

In 1880, Maj. Wilson did not consider that the improvement of the river for navigation was feasible, '81, 2345.

Surveys.

Examination ordered by act of June 14, 1880. Made under the direction of Maj. Wilson, '81, 2343.

SAINT MARY'S RIVER TO GULF OF MEXICO. (See CANAL CONNECTING.)

SAINT MARY'S RIVER AND SAINT MARY'S FALLS CANAL, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 490.)

Appropriations.

1856-79	\$2, 215, 692	
1880. Saint Mary's Falls Canal and River.....	250, 000, '80, 2068.	
1881. Saint Mary's Falls Canal and River.....	150, 000, '81, 2266.	
*1882. Saint Mary's River (Hay Lake Channel).	200, 000, '83, 2299.	
1884. Saint Mary's River (Hay Lake Channel).	125, 000, '84, 2005.	
1886. { Saint Mary's River (Hay Lake Channel).	150, 000, '86, 1781.	
{ Saint Mary's Falls Canal	250, 000, '86, 1789.	
Total	3, 340, 692	
1888. { At Falls.....	1, 000, 000 }	} act of August 11, 1888.
{ Hay Lake Channel.....	500, 000 }	

Statement of appropriations, '80, 2068; '82, 2342.

Commerce.

1880. Canal commerce, '81, 2269.
 1881. Canal commerce, '82, 2356, 2364.
 1882. Canal commerce, '83, 1847.
 1883. Canal commerce, '84, 2018, 2020, 2022.
 1884. Canal commerce, '85, 2109.
 1885. Canal commerce, '86, 1789.
 1886. Canal commerce, '87, 2215, 2224, 2229.
 Increased demands of commerce, '84, 2012, 2015; '85, 2099, 2105, 2106, 2108; '86, 1784, 1786, 1789.
 Necessity for dry-dock, '84, 2031.
 Rules and regulations for use of canal, '85, 2112.
 Comparison between commerce of Saint Mary's Falls Canal and Suez Canal, '87, 2215.

Contracts.

1880. C. S. Barker, for furnishing dredge, at \$9.75 per hour; Williams & Upham, for furnishing dredge, at \$12.50 per hour; C. S. Barker, for canal excavation, at 35 cents per cubic yard; W. S. Pope, for furnishing brass and iron work, at 8 cents per pound; J. Hickler, for furnishing dredge, at \$7.48 per hour, '80, 2070. Failure of Larkin & Patrick, '81, 2264.
 1881. C. S. Barker, for dredging in Saint Mary's River, at 15½ cents per cubic yard; C. S. Barker, for rock removal, at \$1.80 per cubic yard, and revetment construction, at 12 cents per cubic foot, in the canal, '81, 2266.
 1883. J. Hickler, for dredging on Middle Neebish, at 72 cents per cubic yard, '83, 1838.
 1884. J. Hickler, for dredging on Middle Neebish, at 58 cents per cubic yard, '85, 2096.
 1885. Hickler & Green, for dredging on Middle Neebish, at 89 cents per cubic yard, '85, 2098.
 1886. Hickler & Green, for hire of dredge on canal enlargement; C. E. Mitchell, for construction of crib-piers; Durcharme, Fletcher & Co., for iron, '87, 2216, 2218; Hickler & Green, for dredging, at \$1.95 per cubic yard, on Neebish Rapids, '87, 2239, 2246.
 1887. Carkin, Stickney & Cram, for hire of dredge on canal enlargement, '87, 2216, 2218.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 222, 223; '81, 301, 302; '82, 295, 296; '83, 299, 300; '84, 301, 303, 303; '85, 325, 326, 332, 2105; '86, 318, 319; '87, 286, 287.

ENGINEERS IN CHARGE.

Lieut. Col. G. Weitzel, 1873-'83. Reports, '80, 2067, 2071; '81, 2263, 2267; '82, 2341, 2355, 2358.

*The act of August 2, 1882, provided for the application of \$65,000 (balance of tolls offered by State of Michigan) to convert old lock into dry-dock, '81, 388.

**SAINT MARY'S RIVER AND SAINT MARY'S FALLS CANAL,
MICH.—Continued.****Engineers—Continued.**

Maj. F. U. Farquhar, 1883. '83, 1835.

Capt. D. W. Lockwood, 1883. '83, 1835.

Lieut. Col. O. M. Poe, 1883.—. Reports, '83, 1836; '84, 2004, 2016, 2030, 2111; '85, 2098, 2104, 2108, 2124, 2186; '86, 1777, 1783, 1789, 1809, 1823; '87, 2214, 2220, 2227, 2238.

ASSISTANTS.

A. Noble. Reports, '80, 2070, 2071; '81, 2266; '82, 2343.

E. S. Wheeler. Reports, '84, 2005, 2018; '85, 2102, 2110.

Legislation.

Acts of State of Michigan transferring control of canal to the United States, '81, 2267.

State aid for construction of canal, '82, 2360; '86, 1792.

Relating to operation of canal, '80, 278.

Relating to use of old lock as dry-dock, '82, 388.

Relating to transfer of old canal, '80, 278.

Operations.

1879-'80. By hired labor and purchase in open market and also by contract, work was in progress on the locks and on the excavation of material over shallow areas in the canal, '80, 2070. Under contracts the excavation of five shoals was in progress in Saint Mary's River, '80, 2071.

1880-'81. Progress on canal construction, '81, 2267. Dredging and removal of bowlders from shoals in Saint Mary's River, '81, 2267. Canal transferred to the United States, '84, 2030. Operation of canal by United States, '81, 2267.

1881-'82. Progress on canal construction, '82, 2343. Dredging and rock removal from East Neebish, '82, 2344. Tests of cement, '82, 2345. Operation of canal by United States, '82, 2355.

1882-'83. Extension of lock bulkheads and construction of slope wall at locks; removal of 10,912 cubic yards from channel approaching lock and 14,361 cubic yards from west channel of East Neebish, '83, 1839. Formation of a 17-foot dredged channel through Lake George, '83, 1840. Operations of canal by United States, '83, 1846.

1883-'84. Repairs at locks and improvement of grounds, '84, 2014, 2017. 118,180 cubic yards dredged from Middle Neebish, '84, 301, 2006; '86, 1805. Operations of canal by United States, '84, 2016.

1884-'85. 135,664 cubic yards dredged from Middle Neebish, '85, 2098, 2102; '86, 1805. Operations of canal by United States, '85, 2108, 2111.

1885-'86. 90,280 cubic yards removed from Middle Neebish, '86, 1779, 1805. Operations of canal by United States, '86, 1783, 1791, 1809. History of operations, '82, 2358; '86, 1779.

1886-'87. Canal enlargement commenced; 15,700 cubic yards material removed by dredging; operations of drilling scow, '87, 2116. Operation and care of canal, '87, 2227. 10,863 cubic yards removed from Neebish Rapids, '87, 2239-2241.

Physical Characteristics.

Stages of water and rainfall records, '82, 2344; '83, 1840; '84, 2016.

Description of Saint Mary's River, '82, 2358.

Description of bench-marks, '84, 2008; '87, 2242.

Water-level observations, '87, 2217, 2242.

Private and Corporate Work.

Description of canal built by the State, '82, 2360; '86, 1792.

Projects.

In 1852 a grant of 750,000 acres of public land was made to the State of Michigan for the construction of the canal. The grant was transferred to a company who completed the canal and turned it over to the State in 1856, at a cost of \$999,802.46. The canal as thus built was 100 feet wide and 12 feet deep, provided with 2 locks 350 feet long and 70 feet wide, with lifts of 9 feet, '66, iv, 66; '70, 160; '77, 922; '86, 1792.

Previous to 1870 \$210,692 was appropriated by Congress and applied to the improvement of the channel of the river through Lake George and the west channel of East Neebish, '82, 2361; '86, 1793.

In 1869 the State of Michigan provided for the future transfer of the canal to the United States, '69, 106; '70, 163.

In 1870 Congress made the first appropriation for the enlargement of the canal to a width of 100 to 500 feet, with a depth of 16 feet, together with the construction of a new lock 515 feet long, 80 feet wide, and 18 feet lift, at an estimated cost of \$2,460,000, '70, 160; '71, 163; '77, 922; '79, 1644; '82, 2361; '86, 1795.

In 1881 the canal was transferred to the United States by the State of Michigan, '84, 2030.

SAINT MARY'S RIVER AND SAINT MARY'S FALLS CANAL, MICH.—Continued.

Projects—Continued.

- The canal enlargement was completed in 1883, at a cost of \$2,171,000, '82, 2342; '86, 1783, 1801, 1806.
- In 1880 Col. Weitzel proposed the further improvement of the channels of Saint Mary's River, except through East Neebish, so as to obtain a channel 300 feet wide and 16 feet deep, at an estimated cost of \$225,000, '80, 2074.
- In 1882 Col. Weitzel proposed the formation of a channel 300 feet wide and 17 feet deep passing through Sugar Island Rapids and Hay Lake, rejoining the American channel via Middle Neebish. Estimated cost, \$2,127,292, '82, 2367; '83, 1836; '84, 2004, 2016; '86, 1802, 1805.
- In 1885 the proposed depth was increased to 20 feet and the estimated cost to \$2,659,115, '85, 2100; '86, 1778; '87, 2233, 2245.
- By Lieut. Col. Poe, 1884, for a new lock 70 feet wide, 700 feet long, with 21 feet depth, built upon the site of the old locks, with a deepening of the canal above and below the lock. Estimated cost, \$1,609,085, '84, 2012. Increased in 1885 to \$1,750,000, '85, 2105. Revised in 1886 to \$2,552,176, '86, 1785.
- By Lieut. Col. Poe, 1884, for a dry-dock 330 feet long and 18 feet deep, located near east end of area transferred from Fort Brady military reservation. Estimated cost, \$323,872, '84, 2033; '85, 2125.
- Objections against use of old locks for dry-dock, '84, 2030; '85, 2115.
- History of past operations, '86, 1792.
- In 1886 Col. Poe revised the plan and estimates of 1881 for the canal enlargement, wherein the proposed new lock was increased to 800 feet between the gates, 100 feet wide throughout, with 21 feet of water on water-sills. Estimated cost, \$4,738,865, '87, 2215, 2217, 2220, 2223.

Surveys.

- Of navigable channels of Saint Mary's River ordered by act of March 3, 1879, '80, 223. Made under direction of Col. Weitzel, '80, 2071.
- Between Middle Neebish and Sugar Island, 1882, '83, 1836; '84, 2005.
- Report of Lieut. Col. Poe upon use of old locks at Saint Mary's Falls Canal as a dry-dock, '85, 2186.

MAPS.

- Of canal, '80, 2068; '81, 2207; '82, 2342.
- Of Middle Neebish, '84, 2006.
- Of Hay Lake Channel, '87, 2241.

SAINT SIMON'S SOUND, GA.—CONNECTION WITH CUMBERLAND SOUND.

(See CUMBERLAND SOUND, GA.)

SALEM HARBOR, MASS.—EXAMINATION FOR JETTY AT.

(Continued from Vol. I, p. 493.)

Appropriations.

1873-79 \$25,000.

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 66.

ENGINEER IN CHARGE.

Maj. C. W. Raymond. Report, '85, 537.

Plans.

- In 1884 Maj. Raymond did not consider that the harbor would be improved by the jetty proposed, '85, 538.

Surveys.

- Examination ordered by act of July 5, 1884. Made under direction of Maj. Raymond, '85, 537.

SALEM RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 494.)

Appropriations.

1871-79.....	\$7,000
1880.....	3,000, '80, 593.
1881.....	3,000, '81, 792.
1882.....	1,500, '82, 776.

Total 14,500

Statement of appropriations, '87, 812.

Contracts.

1879. American Dredging Company, for dredging, at 35 cents per cubic yard, '80, 593.
 1880. American Dredging Company, for dredging, at 40 cents per cubic yard, '81, 792.
 1881. American Dredging Company, for dredging, at 30 cents per cubic yard, '82, 777.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 96; '81, 125, 129; '82, 123, 126; '83, 123; '84, 132; '85, 124, 127; '86, 122; '87, 84.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 592; '81, 791.

Capt. W. Ludlow, 1882-'83. Report, '82, 775, 814.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 631.

Maj. W. H. Heuer, 1884-'85. Report, '84, 832.

Lieut. Col. H. M. Robert, 1885-'—. Reports, '85, 852, 861; '86, 846; '87, 811.

ASSISTANTS.

J. J. Lee. Report, '83, 632.

A. Stierle. Report, '84, 833.

Operations.

1879-'80. 6,034 cubic yards material dredged from the bar at river mouth, '80, 593.

1880-'81. Dredging continued in increasing width of cut at bar, '81, 791.

1881-'82. Channel 60 feet wide and from 6 to 7 feet deep dredged from head of canal to above the landing, '82, 776.

1882-'87. No operations, '83, 631; '84, 832; '85, 853; '86, 846; '87, 811.

Projects.

Between 1871 and 1881 \$10,000 was applied toward the formation of a channel 8 feet deep at mean low water through the bar obstructing the mouth of the river, '71, 695; '78, 442; '79, 413; '80, 593; '81, 791.

In 1881 operations were transferred to the formation of a channel 60 feet wide and 6 feet deep at low water through the shoals above the head of the canal, '81, 791; '87, 84.

Surveys.

Examination ordered by act of March 3, 1882. Made under direction of Capt. Ludlow, '82, 814.

Examination of mouth ordered by act of July 5, 1884. Made, 1884, under direction of Maj. W. H. Heuer, '85, 860.

SALINE RIVER, ARK.—IMPROVEMENT OF.

(Continued from Vol. I, p. 495.)

Appropriations.

1880.....	\$7,500, '80, 1326.
1881.....	5,000, '81, 1515.
1882.....	4,000, '82, 1586.
1884.....	5,000, '85, 1599.

Total 21,500

Commerce.

Commerce influenced by improvement, '80, 1326.

Commerce does not justify further appropriations, '84, 1404; '86, 1388; '87, 1506, 1546.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 156; '81, 218; '82, 216; '83, 224; '84, 231; '85, 250; '86, 243; '87, 204, 210.

SALINE RIVER, ARK.—Continued.**Engineers—Continued,**
ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaud, 1878-'81. Reports, '80, 1325; '81, 1435.

Capt. T. H. Handbury, 1881-'84. Reports, '81, 1515; '82, 1585; '83, 1174.

Maj. M. B. Adams, 1884-'85. Report, '84, 1404.

Capt. H. S. Taber, 1885—-. Reports, '85, 1598; '86, 1387; '87, 1505, 1546.

ASSISTANT.

E. C. Wiley. Report, '85, 1599.

Operations.

1880-'81. Improvement of river begun by removal of logs and snags, '81, 1435.

1881-'82. 466 snags, 1,300 logs, and 5,633 trees removed, '82, 1585.

1882-'83. 3,772 trees, 554 snags, a dam, a raft, and drift-piles removed, '83, 1174.

1883-'84. No operations, '84, 1404.

1884-'85. 1,200 snags, 3,985 trees, and 1,463 logs removed from channel, '85, 1596.

1886-'87. No operations, '86, 1388; '87, 1506.

In 1887 it was considered that the existing commerce of the river did not justify further expenditures, '87, 1506, 1546.

Projects.

By Maj. Benyaud, 1879, for improvement of river as high as practicable or as will be warranted by commerce, by removal of snags, logs, trees, and similar obstructions. Estimated cost, \$30,151, '79, 1006; '80, 1325.

Further appropriations not recommended, '86, 1388; '87, 1547.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Taber, '87, 1546. Capt. Taber reports further survey or improvement as unnecessary, '87, 1546.

SALKEHATCHIE RIVER, S. C.—IMPROVEMENT OF.**Appropriations.**

1882..... \$5,000, '83, 891.

1884..... 3,000, '84, 1096.

1886..... 2,000, '86, 1086.

1888..... 3,000, act of August 11, 1888.

Commerce.

Value of timber shipment, '84, 1096.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 179; '83, 174; '84, 181; '85, 182; '86, 180; '87, 144.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1880—-. Reports, '81, 1143; '83, 890; '84, 1094; '85, 1192; '86, 1084; '87, 1146.

ASSISTANTS.

Capt. J. C. Post. Report, '81, 1146.

Capt. T. N. Bailey. Reports, '83, 891; '84, 1097.

Lieut. F. V. Abbot. Reports, '85, 1195; '87, 1148.

Operations.

1883-'84. 1,810 snags, roots, trees, and similar obstructions removed from channel, '84, 1095.

1884-'85. 9,490 snags, stumps, and overhanging trees removed, 100 outlets closed and two shoals removed, '85, 1194.

1885-'86. No operations, '86, 1085.

1886-'87. 600 overhanging trees removed, one dam built to remove local shoal, and 29 outlets closed, '87, 1147, 1149.

Physical Characteristics.

Description, '81, 1143.

Projects.

By Col. Gillmore, 1880, for improvement of the river by removal of pile obstructions at Hickory Hill and removal of logs and shoals for a distance of 65 miles to render the river navigable for rafts and flat-boats. Estimated cost, \$18,000, '81, 1144; '87, 1146.

Surveys.

Examination ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Gillmore, '81, 1143.

SALMON RIVER, N. Y., BELOW FORT COVINGTON, N. Y.—
SURVEY OF.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 352.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert. Report, '85, 2286.

ASSISTANT.

L. Y. Schermerhorn. Report, '85, 2289.

Physical Characteristics.

Description of locality, '85, 2287.

Character of river-bed, '85, 2289.

Plans.

By Lieut. Col. Robert, 1884, for the formation of a dredged channel 75 feet wide and 12 feet deep, from Salmon street in Fort Covington to the United States boundary line. Estimated cost, \$40,000, '85, 2288, 2290.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Robert, '85, 2286.

MAPS.

Below Fort Covington, '85, 2290.

SALMON RIVER, N. Y.—EXAMINATION FOR HARBOR OF REFUGE AT
MOUTH OF.

(Continued from Vol. I, p. 495.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 352.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert. Report, '85, 2291.

Plans.

In 885, Lieut. Col. Robert considered that the demands of commerce would not justify the necessary expenditure to construct a harbor of refuge thereat, nor that the locality was worthy of improvement, '85, 2292.

Surveys.

History of previous surveys, '85, 2291.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. Robert, '85, 2291.

SALT RIVER, KY.

Examination ordered by act of August 5, 1886, '87, 249.

SAN ANTONIO CREEK, CAL. (See OAKLAND HARBOR, CAL.)

SAN CARLOS BAY, FLA. (See CHARLOTTE HARBOR, FLA.)

SAND BEACH, LAKE HURON—HARBOR OF REFUGE AT, CONSTRUCTION OF.

(Continued from Vol. I, p. 248.)

Appropriations.

1871-79.....	\$700,000
1880	75,000, '80, 2075.

SAND BEACH, LAKE HURON—Continued.**Appropriations—Continued.**

1881	\$50,000, '81, 2272.
1882	75,000, '82, 2370.
1884	75,000, '84, 2048.
1886	75,000, '86, 1833.

Total 1,050,000

1888 70,000, act of August 11, 1888.

List of appropriations previous to 1880, '81, 2272.

Commerce.

Statement of vessels seeking refuge at harbor from 1877 to 1886, inclusive, '87, 2261.

Contracts.

1880. J. W. McGinn, for timber, '80, 2076. H. T. Stock, furnishing dredge, \$7.60 per hour, '80, 2076. Ducharme, Fletcher & Co., for iron, at 4½ cents per pound, '80, 2076.

1881. C. F. Dunbar, for furnishing dredge, tug, and scows, at \$7.50 per hour, '81, 2272.

1882. T. M. Hubbell, for use of tug, '82, 2370. J. Van Buskirk, for timber, '83, 1871. J. Stover, for iron, at 3 cents per pound, '83, 1872. J. Hickler, for hire of dredge, tug, and two scows, '83, 1872.

1883. Blanchard & McAlpine, for use of tug, '83, 1872.

1884. Brooks, Joslyn & Co., for timber and plank, '85, 2151. G. Talbot, for furnishing a dredge, a tug, and two dump scows, '85, 2151. C. Currie, for furnishing tug, '85, 2151. W. H. McCurdy & Co., for iron, '85, 2151.

1885. I. P. Donaldson, for paints and oils, '85, 2157.

1886. Brooks & Joslyn, for timber, '86, 1830. H. D. Edwards, for supplies, '86, 1833. J. Jenks & Co., for supplies, '86, 1834. D. Bell, for steam-launch construction, at \$5,250, '86, 1837. H. Howard & Co., for furnishing timber and iron, '87, 2258.

1887. Brooks, Joslyn & Co., for timber; Ducharme, Fletcher & Co., for iron; McNellis & Johnson, for stone, '76, 2257.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 222; '81, 302; '82, 296; '83, 303; '84, 305; '85, 328; '86, 322; '87, 290, 291.

ENGINEERS IN CHARGE.

Maj. G. Weitzel, 1873-'83. Reports, '80, 2074; '81, 2270; '82, 2369.

Lieut. Col. O. M. Poe, 1883-'—. Reports, '83, 1870; '84, 2046; '85, 2151; '86, 1829, 1836; '87, 2256, 2261.

ASSISTANT.

C. P. Gilbert. Reports, '80, 2076; '81, 2273; '82, 2370; '83, 1872; '84, 2048.

Operations.

1879-'80. 585 linear feet crib-work placed in extension of lake arm of breakwater; 650 linear feet superstructure built and filled, '80, 2074, 2075.

1880-'81. 585 linear feet superstructure built; 580 linear feet crib-work sunk in extension of lake arm of breakwater, '81, 2271.

1881-'82. 520 linear feet crib-work added to lake arm of breakwater, '82, 2369.

1882-'83. 520 linear feet crib-work added to south arm of breakwater, '83, 1870.

1883-'84. 2,755 linear feet crib-work placed in breakwater; 49,039 cubic yards material dredged, '84, 2046.

1884-'85. 1,075 linear feet superstructure built, 27,740 cubic yards material dredged, and 260 linear feet face-wall built, '85, 2152.

1885-'86. Extensive repair and reconstruction work done on piers damaged by storm, '86, 1827. Construction of steam-launch commenced under contract, '86, 1829, 1836.

1886-'87. Extensive repairs to cribs in progress, '87, 2256. Completion of steam-launch at a cost of \$5,901, '87, 2261.

Projects.

By Board of Engineers, 1871, for harbor of refuge formed by a breakwater, composed of a sea and shore arm of an aggregate length of 7,000 feet, and consisting of timber crib-work with stone filling, inclosing an area which is to be deepened by dredging where necessary. Cost estimated by Board at \$1,452,550, '73, 294; '77, 927; '85, 2156.

In 1877, under the experience of work already done, the project might be accomplished for \$555,000, '78-'79, after the appropriation of \$1,050,000, it was required to complete the project, inclusive of vs.

considered that
'87, 2258.
1,000 would
258.

2372; '84, 2048; '85, 2156; '86, 1830.

SAN DIEGO HARBOR, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 496.)

Appropriations.

1852-'79.....	\$111,000
1886. Survey of San Diego, Newport, and San Luis Obispo harbors.....	5,000, '87, 2433.
1888.....	1,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 236; '81, 324; '82, 318, '83, 330; '84, 334; '85, 360; '86, 353; '87, 320.

ENGINEERS IN CHARGE.

Col. C. S. Stewart, 1875-'87. Reports, '80, 2247; '81, 2525; '82, 2641; '83, 1995; '84, 2213; '85, 2349; '86, 1917.

Maj. W. H. H. Benyard, 1887-'— Report, '87, 2431.

Operations.

1879-'80. Repairs to levee embankments, '80, 2247.
 1880-'81. Repairs to levee embankments, '81, 2525.
 1881-'82. Repairs to levee embankments, '82, 2641.
 1882-'83. Repairs to levee embankments, '83, 1995.
 1883-'84. Repairs to levee embankments, '84, 2213.
 1884-'85. Repairs to levee embankments, '85, 2349.
 1885-'87. No repairs, '86, 1917; '87, 2431.

Projects.

The project of 1875 proposed the improvement of San Diego Harbor by changing the river back into one of its former outlets in False Bay by cutting a new channel and closing the old one by an embankment, '76, ii, 632. The project was completed in 1877, '77, 999. Subsequent operations confined to repairs to embankments, '86, 1917; '87, 2431.

SANDUSKY CITY HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 497.)

Appropriations.

1826-'79.....	\$222,980
1880.....	12,500, '80, 2111.
1881.....	10,000, '81, 2295.
1882.....	10,000, '82, 2391.
1884.....	*20,000, '84, 2090.
1886.....	5,000, '86, 1857.
Total.....	280,480
1888.....	40,000, act of August 11, 1888.

Commerce.

Commercial statistics, '87, 2340.

Contracts.

1879. J. C. & J. H. Davis, for dredging, at 12 cents per cubic yard, '80, 2111.
 1880. W. Richardson, for dredging, at 20 cents per cubic yard, '81, 2295.
 1881. W. Richardson, for dredging, at 16 cents per cubic yard, '81, 2295.
 1882. W. Richardson, for dredging, at 12 cents per cubic yard, '83, 1896.
 1884. Stang & Gillmore, for dredging, at 17½ cents per cubic yard, '85, 2218.
 1886. Carlin, Stickney & Cram, for dredging, at 15 cents per cubic yard, '87, 2303.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 224; '81, 306; '82, 300; '83, 308; '84, 311; '85, 335; '86, 330; '87, 297, 303.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2105; '81, 2293; '82, 2380.

Maj. L. C. Overman, 1883-'— Reports, '83, 1894; '84, 2088; '85, 2216; '86, 1855; '87, 2302, 2335.

* See act of August 5, 1886; '86, 447.

SANDUSKY CITY HARBOR, OHIO—Continued.**Operations.**

History of the work, '80, 2105.

1879-'80. 80,861 cubic yards material dredged from channel and outer bar, '80, 2109.

1890-'81. 48,656 cubic yards material dredged from channel on the "Clock" and "Middle" ranges, '81, 2294.

1881-'82. 49,934 cubic yards material dredged within the bay and from channel through outer bar, '82, 2390.

1882-'83. 60,000 cubic yards material dredged from channel parallel to city docks and the "Clock" Range, '83, 1896.

1883-'84. 10,000 cubic yards material dredged from the outer bar, '84, 2069.

1884-'85. 51,941 cubic yards material dredged from channel through the bar, '85, 2217.

1885-'86. No operations for lack of funds, '86, 1855.

1886-'87. Dredging in progress, '87, 2302.

Plans.

By Maj. Wilson, 1882, for increasing the channel depth to 16 feet, at an estimated cost of \$61,000, '82, 2390; '87, 2337.

By Maj. Overman, 1887, for increasing channel depth to 17 feet, at an estimated cost of \$111,000, '87, 2337.

By Maj. Overman, 1887, for the formation of a straight channel by dredging from the north end of Cedar Point to the east end of the existing channel in front of the city, the channel to be 200 feet wide and 17 feet deep. Estimated cost, \$96,712, '87, 2337, 2339.

Projects.

From 1844 to 1879, inclusive, \$222,580 was appropriated and expended on the protection of Peninsula Point and in dredging on the outer and inner bars, '80, 2105-2109; '87, 2305.

History of operations and projects prior to 1880, '80, 2105.

By Lieut. Col. N. Michler, 1877, extended as to limits of channel by Maj. Wilson, 1880, provides for excavation of a channel 200 feet wide and 15 feet deep through the outer bar and in the bay up to within 50 feet of the dock-line, and then, parallel to the docks, with a width of 100 feet and a depth of 15 feet, '80, 2110; '87, 2302, 2336.

From 1880 to 1886, inclusive, \$67,500 was appropriated and applied upon the project of 1880. In 1887 \$61,000 was estimated as required for completion of entire project, '87, 2305.

Surveys.

Of harbor made, 1879, '80, 2109.

Survey ordered by act of August 5, 1886, from north end of Cedar Point to east end of existing channel. Made under direction of Maj. Overman, '87, 2336.

SANDUSKY RIVER, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 499.)

Appropriations.

1867-'79.....	\$30,000
1880	10,000, '80, 2114.
1881	7,500, '81, 2298.
1882	4,000, '82, 2392.

Total 51,500

Contracts.

1880. W. Richardson, for dredging, at 19 cents per cubic yard, '81, 2299.

1881. W. Richardson, for dredging, at 17 cents per cubic yard, '81, 2299.

1882. L. P. & J. A. Smith, for dredging, at 12 cents per cubic yard, '83, 1898.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 225; '81, 307, 314; '82, 301; '83, 309; '84, 312; '85, 337; '86, 331; '87, 298.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1880-'83. Reports, '80, 2112, 2114; '81, 2296, 2299; '82, 2391.

Maj. L. C. Overman, 1883-'— . Reports, '83, 1897; '84, 2091; '85, 2218; '86, 1857; '87, 2305.

SANDUSKY RIVER, OHIO—Continued.**Operations.**

History of the work, '80, 2112.

1880-'81. 44,976 cubic yards material dredged from the various bars, '81, 2297.

1881-'82. 38,000 cubic yards material dredged from channel through outer bar, '82, 2392.

1882-'83. 25,000 cubic yards material dredged from channel in the bay, '83, 1897.

1883-'87. No operations, '84, 2091; '85, 2219; '86, 1857; '87, 2306.

Physical Characteristics.

Description of river and its obstructions, '81, 2300.

Projects.

From 1867 to 1872, inclusive, \$30,000 was appropriated and expended in formation of a dredged channel through the bars below Fremont, '80, 2112.

Ry Maj. Wilson, 1880, for improvement of river, by excavation of a channel 100 feet in width and 9 feet in depth through the various bars between the city of Fremont and the 9-foot curve in Sandusky Bay. Estimated cost, \$44,000, '81, 2297, 2298; '87, 2306.

Surveys.

Of river near Fremont ordered by act of June 14, 1880. Made, 1890, under direction of Maj. Wilson, '81, 2299.

SANDY BAY (Rockport), MASS.—HARBOR OF REFUGE AT.**Appropriations.**

1829-'47 \$69, 232. 57.

1884 100, 000, '85, 521.

1886 100, 000, '86, 583.

1888 100, 000, act of August 11, 1888.

Commerce.

Necessity for harbor of refuge, '84, 571, 578; '85, 525.

Advantages of Sandy Bay as a harbor of refuge, '85, 529.

Anchorage capacity of harbor, '84, 579; '85, 531.

Requirements of a harbor of refuge, '85, 523.

Statistics relating to wrecks, '85, 529.

Contracts.

1885. Pidgeon Hill Granite Company, for rubble-stone for breakwater construction, at \$1.67 per ton, '86, 582.

1886. Bridgewater Iron and Steel Company, for a wrought-iron spindle to mark Avery's Ledge, at 5½ cents per pound, '86, 582. G. W. Townsend, for drilling hole in rock to receive iron spindle for \$900, '86, 582. G. W. & F. Smith, for cast-iron ring to hold spindle in place, '86, 582. Rockport and Pidgeon Hill Granite Company, for breakwater stone, at 71 cents per ton, '87, 498.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 79; '85, 66, 522; '86, 67; '87, 24.

BOARD OF ENGINEERS.

Constituted by S. O. No. 91, C. of E., 1884, to consider location, plan, and estimates for a national harbor of refuge at Sandy Bay, Mass. Report, '85, 523, 528. (Col. Blunt, Lieut. Cols. Craighill and McFarland, and Maj. Raymond.)

ENGINEERS IN CHARGE.

Col. G. Thom, 1882-'83. Report, '84, 565.

Maj. C. W. Raymond, 1883-'86. Reports, '84, 565; '85, 520, 530.

Lieut. Col. G. L. Gillespie, 1886-'—. Reports, '86, 580; '87, 497.

ASSISTANT.

S. Haagensen. Report, '84, 576.

Operations.

1885-'86. 49,762 tons of rubble-stone placed in the breakwater, '86, 582.

1886-'87. 109,237 tons of stone deposited in breakwater; iron spindle erected on Avery's Ledge, '87, 498.

Physical Characteristics.

Description of Sandy Bay, '84, 565, 577.

Tidal observations, '84, 577.

Character of bottom, '84, 577.

Plans.

Location of breakwater proposed by Col. Thom, 1882, '84, 566.

SANDY BAY, MASS.—Continued.**Plans—Continued.**

Location proposed by Maj. Raymond, 1883, beginning at Avery's Ledge, thence north by west, one-half west, for a distance of 3,000 feet; thence coming to the westward for a distance of 1,200 feet; thence northwest for a distance of 4,820 feet, the breakwater to consist of an enrockment of granite quarry grout, with its top surface 15 feet below low water, surmounted with masonry superstructure carried 8 feet above high water. Estimated cost, \$4,000,000, '84, 567-570; '85, 520; '86, 582. Consideration of cross-section, '84, 571.

The Board of Engineers recommend location proposed by Maj. Raymond if a national harbor of refuge of the first-class is to be constructed, '85, 529.

Location suggested by Board of Engineers, 1884, for a smaller breakwater at an estimated cost of \$1,000,000, '85, 529, 531.

Projects.

The project of Maj. Raymond of 1884 contemplates the construction of a "national harbor of refuge of the first-class" at Sandy Bay, Mass. The project, as approved by the Board of Engineers of 1884, was for a breakwater about 9,000 feet long, starting at Avery's Ledge and running to Abner's Ledge; thence in a northwesterly direction to the 26-foot curve of depth off Andrew's Point, the breakwater to be formed to the level of 22 feet below low water of random stone and with a width at top of 40 feet, above which will be built a masonry wall whose top will be 15 feet wide and carried 8 feet above high water. The details of the masonry construction were not definitely adopted. The estimated cost of the work was about \$5,000,000, with \$2,500,000 additional for buoyage, lighting, and defense, '84, 567, 570; '85, 229; '86, 67, 581, 582; '87, 24, 497, 498.

In 1885 Maj. Raymond proposed the construction of a pier upon Avery's Ledge to define its locality and to form one end of a future breakwater, '86, 581.

Surveys.

Ordered by act of August 2, 1882. Preliminary examination made under direction of Col. Thom, '84, 562. Survey, 1883, made under direction of Maj. Raymond, '84, 565.

MAPS.

Showing proposed location of breakwater, '86, 582; '87, 498.

SANDY HOOK BAR, channel through. (See NEW YORK HARBOR, N. Y.)**SANDY RIVER, VA. AND KY. (See BIG SANDY RIVER.)****SAN FRANCISCO HARBOR AND INTERIOR BAYS—SURVEY OF.**

(Continued from Vol. I, p. 501.)

Appropriations.

1886..... \$11,000, '87, 2426.

Engineers.

CHIEF OF ENGINEERS.

Report, '87, 318.

ENGINEER IN CHARGE.

Col. G. H. Mendell. Report, '87, 2426.

Surveys.

Ordered by act of August 5, 1886, '87, 2426.

SANGAMON RIVER, ILL.—EXAMINATION OF.**Commerce.**

Commercial statistics, '84, 1953, 1956.

Bridges without draws, '84, 1954.

SANGAMON RIVER, ILL.—Continued.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 291.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard. Report, '84, 1952.

Physical Characteristics.

Description of river, '84, 1955.

Plans.

By Maj. Benyaard, 1884, for the improvement of the river from its mouth to Petersburg, so as to be navigable at or above a 4-foot stage, by removal of natural obstructions, closing outlets, and rectifying the channel at bends. Estimated cost, \$60,000, '84, 1957.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Benyaard, '84, 1952.

SAN JACINTO RIVER. (See GALVESTON BAY SHIP CANAL, TEX.)**SAN JOAQUIN RIVER, CAL.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 501.)

Appropriations.

1876.....	\$20,000
1880.....	20,000, '80, 236.
1881.....	40,000, '81, 2474.
1882.....	40,000, '82, 2538.
1884.....	20,000, '84, 2197.
1886.....	18,750, '86, 1923.

Total 158,750

1888..... 25,000, act of August 11, 1888.

Contracts.

1880. B. C. Jackson, cut-off excavation, at 23 cents per cubic yard, '81, 2475.

1881. Oakland Dredging Company, cut-off excavation, at 33 cents per cubic yard, '81, 2475. T. H. Williams, for dredging, at 45 cents per cubic yard, '81, 2475. A. Gall, for dredging, at 46 cents per cubic yard, '81, 2475. N. H. Eaton, for snagging, at \$62.50 per snag, '82, 2539. J. M. Lemon, for brush dam construction, '82, 2539.

1882. A. Gall, for dredging, at 40 cents per cubic yard, '83, 1975. A. McKinnon, for barrier construction, at \$3.50 per linear foot, '83, 1975.

1883. W. Gwynn, for dredging, at 16 cents per cubic yard, '83, 1975. J. Hackett, for dredging, at 23 cents per cubic yard, '84, 2198.

1884. T. H. Williams, for dredging, at 15 cents per cubic yard, '85, 2355. Von Schmidt & McNea, for dredging, at 17.49 cents per cubic yard, '85, 2355.

1886. H. Lynch, for dredging, at 24 cents per cubic yard, '87, 2440.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 236; '81, 322; '82, 316; '83, 328; '84, 332; '85, 361; '86, 354; '87, 321.

ENGINEERS IN CHARGE.

Lieut. Col. C. S. Stewart, 1875-'81. Report, '80, 2248.

Lieut. Col. G. H. Mendell, 1881-'85. Reports, '81, 2476; '82, 2536; '83, 1973; '84, 2195.

Capt. A. H. Payson, 1885-'—. Reports, '85, 2353; '86, 1921; '87, 2437.

ASSISTANT.

W. P. Smith. Reports, '83, 1976; '85, 2356.

Operations.

No operations from 1878 to 1880.

1880-'81. 8,760 cubic yards material dredged from Stockton Slough, '81, 2473.

1881-'82. 81,708 cubic yards material dredged from Stockton and Mormon's sloughs, under contract; 21,142 cubic yards material dredged from Stockton Slough by city of Stockton; 111 snags removed; brush dams built at four localities, '82, 2536, 2537.

SAN JOAQUIN RIVER, CAL.—Continued.**Operations—Continued.**

1882-'83. 17,580 cubic yards material dredged from Mormon's Slough; 350 linear feet of timber barrier built; 89 snags removed from river-bed, '83, 1973, 1974.

1883-'84. 77,233 cubic yards material dredged at Mormon's Slough and Devil's Elbow; 6 snags removed and 230 linear feet of brush dam built on upper river, '84, 2196.

1884-'85. 168,930 cubic yards material dredged; sunken dredge removed from lower approach; 98 snags removed, '85, 2354.

1885-'86. No operations for lack of funds, '86, 1921.

1886-'87. 18,819 cubic yards material dredged and 86 snags removed, '87, 2438.

Private and Corporate Work.

21,142 cubic yards material dredged from Stockton Slough in 1882 by city of Stockton, '82, 2536.

Projects.

The general project under which work has been carried on has for its object the improvement of the San Joaquin River by removal of snags and points of land, excavation of cut-offs, and dredging Stockton Channel, '75, ii, 729; '78, 1302. Also maintenance, by dredging, of a 9-foot low-water channel 100 feet wide through tidal parts of river below Stockton, a 4-foot low-water channel 80 feet wide in Mormon's Slough to Miller's warehouse, and temporary improvements in the low-water channels of upper river to Hill's Ferry, '81, 2476; '86, 1921.

In 1887 it was estimated that \$139,000 would be required for the improvement of Paradise Cut and Cut-offs, '87, 2439.

SAN LUIS OBISPO, CAL.—EXAMINATION OF HARBOR FOR BREAKWATER AT

(See also SAN DIEGO HARBOR, CAL.)

(Continued from Vol. I, p. 502.)

[£25,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Report, '81, 324; '87, 320.

ENGINEERS IN CHARGE.

Lieut. Col. C. S. Stewart. Report, '81, 2526.

Maj. W. H. H. Benyaard. Report, '87, 2433.

ASSISTANT.

Lieut. A. H. Payson. Report, '81, 2527.

Plans.

In 1879, Col. Stewart estimated that the improvement of the harbor would cost over \$7,000,000 and that a harbor of refuge at this point was not required, '79, 1760.

In 1881 the same views were repeated, '81, 2526; '87, 2434.

By Maj. Benyaard, 1887, for the construction of a breakwater about one-fourth of a mile long along the sunken reef near Whalers' Island. Estimated cost, \$284,898, '87, 2434, 2435.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Col. Stewart, '81, 2126.

Survey ordered by act of August 5, 1886. Made under direction of Maj. Benyaard, '87, 2432.

SAN MATEO RIVER, CAL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 360.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '85, 2342.

SAV MATEO RIVER, CAL.—Continued.**Plans.**

In 1884, the river having been closed by a dam, Lieut. Col. Mendell did not consider the river worthy of improvement, '85, 2343.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Lieut. Col. Mendell, '85, 2342.

SAN PEDRO BAY, CAL.

Examination ordered by act of August 5, 1886, '87, 320.

SANTA MONICA BAY, CAL.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 334.

ENGINEER IN CHARGE.

Lieut. Col. G. H. Mendell. Report, '84, 2209.

Plans.

In 1882 Lieut. Col. Mendell, in view of the fact that the locality had no commerce, did not consider the improvement a public necessity, '84, 2210.

Surveys.

Examination ordered by act of August 2, 1882. Made under the direction of Lieut. Col. Mendell, '84, 2209.

SANTEE RIVER AND CANAL, S. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 503.)

Appropriations.

1881.....	\$22,000, '81, 1033.
1882.....	20,000, '82, 1111.
1884.....	15,000, '84, 1050.
1886.....	18,750, '86, 1035.

Total 75,750

1888..... 24,000, act of August 11, 1888.

Contracts.

1886. R. Moore, for dredging, at 37 cents per cubic yard, '87, 1085.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 125, 132; '81, 167, 179; '82, 162; '83, 170; '84, 175; '85, 175; '86, 173, 1040, '87, 136.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'81. Report, '80, 916.

Lieut. Col. Q. A. Gillmore, 1881. Report, '81, 1148.

Capt. J. Mercur, 1881-'84. Reports, '81, 1033; '82, 1110; '83, 870.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1049.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1119; '86, 1030, 1041; '87, 1081.

ASSISTANTS.

J. M. Wolbrecht. Report, '80, 918.

Capt. J. C. Post. Report, '81, 1156.

R. Whitford. Reports, '84, 1050; '85, 1120; '86, 1036, 1043, 1052; '87, 1085.

Operations.

History of operations, '86, 1036.

1884-'85. 47,625 cubic yards material dredged from the canal, '85, 1119.

1885-'86. Draw-bridge built across Mosquito Creek; 13,354 cubic yards dredged from canal; also 12 stumps removed, '86, 1032.

1886-'87. 9,222 cubic yards material dredged from canal, diking and draining ground, '87, 1082, 1083, 1087.

SANTEE RIVER AND CANAL, S. C.—Continued**Physical Characteristics.**

General features, '86, 1036.

Projects.

By Capt. Phillips, 1880, for improvement of the river by excavation of a channel having a width of 50 feet and a low-water depth of from 5 to 7 feet; also for canal through Mosquito Creek to Winyaw Bay, with 50 feet width and 7 feet low-water depth. Estimated cost, \$104,427, '80, 918, 919; '86, 1036; '87, 1081.

Surveys.

Examination ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 916.

For the reopening of the Santee Canal ordered by act of June 14, 1880. Made, 1881, under direction of Lieut. Col. Gillmore, '81, 1148.

MAPS.

'84, 1050; '85, 1120; '86, 1039.

SARANAC RIVER, N. Y. (See PLATTSBURGH HARBOR, N. Y.)**SASSAFRAS RIVER, MD., above Georgetown—SURVEY OF.****Commerce.**

Commercial statistics, '85, 913, 914.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 137.

ENGINEER IN CHARGE.

W. F. Smith, U. S. Agent. Report, '85, 912, 914.

ASSISTANTS.

C. M. Bird. Report, '85, 912.

V. M. Newton. Report, '85, 914.

Physical Characteristics.

Description of river, '85, 913.

Plans.

By W. F. Smith, 1885, for the formation of a dredged channel from 75 to 100 feet wide and 10 feet deep at mean low water from Georgetown to Lime Landing. Estimated cost, \$56,527, '85, 915, 916.

Surveys.

Ordered by act of July 5, 1884.

SAUGATUCK HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 503.)

Appropriations.

1868-'79	\$105,439
1880	5,000, '80, 2028.
1881	5,000, '81, 2034.
1882	8,000, '82, 2315.
1884	4,000, '84, 1991.
1886	8,000, '86, 1770.

Total	135,439
1888	5,000, act of August 11, 1888.

Contracts.

1880. I. F. Geer, for revetment construction, '81, 2234.

1887. I. F. Geer, for brush, at \$2.90 per cord; S. Bedford, for timber, pile, and stone; Kelly, Maus & Co., for iron, '87, 2197.

SAUGATUCK HARBOR, MICH.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 217; '81, 295; '82, 290; '83, 297; '84, 299; '85, 321; '86, 315; '87, 283.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80, '80, 2007.

Maj. F. Harwood, 1880-'82. Reports, '80, 2027; '81, 2233.

Maj. D. P. Heap, 1882-'83. Report, '82, 2314.

Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1828; '84, 1989; '85, 2084; '86, 1769; '87, 2196.

Operations.

1879-'80. No operations, '80, 2027.

1880-'81. 520 feet of pile and edging revetment built; 10,818 cubic yards sand dredged from lower reach of revetment, '81, 2233.

1881-'82. 673 linear feet pile and edging revetment built; cut 1,560 feet long, 24 feet wide, and 12 feet deep dredged through sand deposit, '82, 2315.

1882-'83. Minor repairs to south pier, '83, 1928.

1883-'84. 175 piles removed from pile-dike above the bend; 33,890 cubic yards material dredged from bar at entrance and channel between the piers, '84, 1990.

1884-'85. Repairs to south pier, pier-head beacon, and inner work, '85, 2084.

1885-'87. No operations, '86, 1770; '87, 2196.

Projects.

Prior to the adoption of the existing project in 1869, a well-constructed abutment pier had been built by private enterprise, '67, 130; '69, 190; '74, i, 190; '76, ii, 509.

The project of 1869 provided for the extension of two parallel piers, about 220 feet apart, connecting the Kalamazoo River with Lake Michigan, so as to provide a channel entrance of navigable width and 10 feet deep, '69, 100, 101; '74, i, 190; '76, ii, 507, 510.

The recommendations of the Board of Engineers of 1875 provided for the extensive repair of revetment already built, '75, i, 258; '76, ii, 509; '87, 2196.

SAUGERTIES HARBOR, N. Y.—IMPROVEMENT OF.**Appropriations.**

1884..... \$5,000, '85, 700.

1886..... 15,000, '86, 670.

1888..... 12,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 105; '85, 95; '86, 93; '87, 57.

ENGINEERS IN CHARGE.

Col. J. Newton, 1884. Report, '84, 715.

Lieut. Col. W. McFarland, 1885-'—. Reports, '85, 699; '86, 669; '87, 660.

Operations.

1885-'86. 29,000 cubic yards material dredged from the bar at the mouth of the creek, '86, 670.

1886-'87. No operations, '87, 661.

Plans.

By Col. Newton, 1884, for improvement of the harbor by excavation of a channel from 1,900 to 2,500 feet long, 100 feet wide, and 7 feet deep at mean low water; also construction of two parallel dikes. Estimated cost from \$41,000 to \$46,000, '84, 716; '85, 699; '86, 669; '87, 662.

Private and Corporate Work.

Dredging by State of New York, '86, 670; '87, 661.

Projects.

By Lieut. Col. McFarland, 1887, for the formation of a channel 300 feet wide and 8 feet deep at mean low water by the construction of parallel dikes 2,300 feet long, with dredging in the channel between the dykes if necessary. Estimated cost, \$52,000, '87, 662.

Surveys.

Ordered by act of August 2, 1882. Made, 1885, under direction of Col. Newton, '85, 699.

SAULT SAINTE MARIE CANAL. (See SAINT MARY'S RIVER, MICH.)**SAVANNAH RIVER, above Augusta, Ga.—IMPROVEMENT OF.****Appropriations.**

1880.....	\$16,000, '80, 969.
1881.....	8,000, '81, 1104.
1882.....	15,000, '82, 1175.

Statement of appropriations, '87, 1173.

Contracts.

1880. Anderson & Blaisdell, for dam construction and removal of obstructions, '81, 1104.

1883. W. H. Browne, for rock removal and wing-dam construction, '83, 913.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 129; '81, 174; '82, 169; '83, 178; '84, 185; '85, 185; '86, 184; '87, 148.

ENGINEER IN CHARGE.

Col. Gillmore, 1872— Reports, '80, 968; '81, 1103; '82, 1174; '83, 911; '84, 1110; '85, 1213; '86, 1100; '87, 1172.

ASSISTANTS.

Capt. B. D. Greene. Reports, '81, 1104; '82, 1175.

Lieut. T. N. Bailey. Report, '83, 913.

Capt. J. C. Post. Report, '83, 914.

Lieut. F. V. Abbot. Report, '85, 1214.

Operations.

1880-'81. 722 cubic yards rock and gravel removed, '81, 1103.

1881-'82. 3,365 cubic yards rock and 35 cubic yards gravel removed, and 1,800 cubic yards riprap dams built, '82, 1174.

1882-'83. 439 cubic yards rock excavated and 6,669 square yards of mattress and 1,726 cubic yards of stone employed in wing-dam construction, '83, 912.

1883-'84. 302 cubic yards ledge rock removed, '84, 1110.

1884-'87. No operations, '85, 1213; '86, 1101; '87, 1173.

Projects.

By Col. Gillmore, 1879, for improvement of Savannah River from Augusta to head of pole-boat navigation on the Tugaloo, a distance of 154 miles, by formation of a 3-foot channel 30 feet wide from Augusta to Trotter's Shoal, 64 miles, and removal of rocks, snags, and similar obstructions for the remaining distance. Estimated cost, \$45,000, '80, 958, 959; '87, 1172.

Further appropriations not recommended, because the cost of the permanent improvement of the river would be disproportionate to the requirements of commerce, '87, 1173.

Surveys.

Examination made above Augusta, 1878, under direction of Col. Gillmore, '79, 447-450.

MAPS.

'86, 1094.

SAVANNAH RIVER, between Savannah and Augusta, Ga.—IMPROVEMENT OF.**Appropriations.**

1881.....	\$15,000, '81, 1090.
1882.....	25,000, '82, 1173.
1884.....	15,000, '84, 1109.
1886.....	15,000, '86, 1100.

Total 70,000

1888..... 21,000, act of August 11, 1888.

Statement of appropriations, '87, 1170.

Contracts.

1883. J. E. Walter, for wing-dam construction, '83, 908.

1884. E. H. Gaynor, for wing-dam construction, '85, 1211.

1886. J. F. Gaynor, for wing-dam construction, '87, 1170.

SAVANNAH RIVER, GA.—Continued.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 173; '82, 168; '83, 177; '84, 184; '85, 184; '86, 183; '87, 146.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1872-' —. Reports, '81, 1088, 1090; '82, 1171; '83, 905; '84, 1107; '85, 1207; '86, 1098; '87, 1165.

ASSISTANTS.

S. L. Fremont. Report, '81, 1094.

Capt. B. D. Greene. Report, '82, 1173.

Capt. T. N. Bailey. Reports, '83, 909; '84, 1109.

Capt. J. C. Post. Report, '83, 910.

Lieut. O. M. Carter. Reports, '85, 1212; '87, 1172.

Lieut. F. V. Abbot. Reports, '85, 1211; '87, 1171.

Operations.

1881-'82. Snag-boat built; 144 snags and logs and 141 trees removed from river-bed, '82, 1172.

1882-'83. 5 wing-dams built, averaging 275 feet in length; snags, piles, and flat-boat wrecks removed, '83, 906, 907.

1883-'84. 117 snags and piles and 45 trees removed from the river, '84, 1108.

1884-'85. 2 wing-dams built and 2 completed at Course's Bar; 5 wing-dams built at Sand Bar, Ferry Bar, and 4 at Blue House Bar; 358 snags, 11 stumps, and 385 trees removed, '85, 1210.

1885-'86. No operations for lack of funds, '86, 1099.

1886-'87. Wing-dams built at Blue House Bar and Course's Bar; 259 logs and snags and 596 leaning trees removed from river between Savannah and Mason's Ferry, '87, 1167, 1171, 1172.

Projects.

By Col. Gillmore, 1880, for securing a 5-foot low-water channel between Savannah and Augusta, by dredging, contraction of river, bank protection, and the removal of logs, snags, and similar obstructions. Estimated cost, \$91,000, '80, 1094; '86, 1098; '87, 1166.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Gillmore, '81, 1090.

MAPS.

'83, 908; '84, 1106; '85, 1210; '86, 1094.

SAVANNAH RIVER, at and below Savannah. Ga.—IMPROVEMENT OF.

(Continued from Vol. I, p. 505.)

Appropriations.

1826-'79.....	\$994,606.64
1880.....	65,000.00, '80, 941.
1881.....	65,000.00, '81, 1083.
1882.....	200,000.00, '82, 1150.
1884.....	200,000.00, '84, 1104.
1886.....	150,000.00, '86, 1094.
Total.....	1,674,606.64
1888.....	180,000.00 act of August 11, 1888.
Statement of appropriations, '87, 1158.	

Commerce.

Present and prospective, '81, 1075, 1087.

Contracts.

1879. R. C. McKay, for dam construction, '80, 942.

1880. American Dredging Company, for dredging, at 14 cents per cubic yard, '81, 1083.

1881. M. Bangs, for material, '82, 1148.

1882. Dickerson & Paulson, for dredging, at 15 cents per cubic yard, '82, 1150. E. T. Bangs, for wing-dam and training-wall construction, '83, 900. Dickerson & Paulson, for dredging, at 16½ cents per cubic yard, '83, 900.

1884. J. F. Gaynor, for training-wall and wing-dam construction, '85, 1203. P. S. Ross, for dredging, at 17½ cents per cubic yard, '85, 1204.

SAVANNAH RIVER, GA.—Continued.

Contracts—Continued.

1886. J. F. Gaynor, for wing-dam construction, at 38 cents per square yard, formatress, and \$3 per cubic yard for stone; J. F. Gaynor, for dredging, at 19 cents per cubic yard, '87, 1159.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 127; '81, 171, 180; '82, 167, 175; '83, 175; '84, 183; '85, 182; '86, 182; '87, 145, 154.

BOARD OF ENGINEERS.

Convened at New York July 25, 1879, by S. O. No. 36, C. of E., to report upon further improvement of Savannah River and Harbor. Report, '80, 946. (Cols. Tower and Newton and Lieut. Col. Gillmore.)

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1872—'. Reports, '80, 933, 948; '81, 1074; '82, 1142, 1167; '83, 893; '84, 1093; '85, 1195; '86, 1086; '87, 1150.

ASSISTANTS.

S. L. Fremont. Reports, '80, 944; '81, 1083; '82, 1169.

Capt. B. D. Green. Report, '82, 1150-1167.

Lieut. T. N. Bailey. Reports, '83, 900; '84, 1104.

Capt. J. C. Post. Report '83, 904.

Lieut. O. M. Carter. Reports, '85, 1204; '86, 1094; '87, 1160.

Operations.

1879-'80. 170,359 cubic yards material dredged at Front River, Garden Banks, Elba Island, cut in Old King's Island Jetty, and new channel at "The Wrecks;" 185 linear feet of apron foundation laid and 1,108 cubic yards stone placed on Cross-Tides Dam superstructure; 425 linear feet of south channel apron dam completed, '80, 936, 939.

1880-'81. Cross-Tides Dam completed; gap through Old King's Island Jetty widened to 70 feet; work continued on south channel submerged dam; 268,220 cubic yards material dredged at various localities from Cross Tides to Tybee Roads, '81, 1081.

1881-'82. 2,638 cubic yards stone added to Cross Tides Dam; two brush and stone wing-dams, aggregating 650 linear feet, built between city front and Fig Island; 113,701 cubic yards material dredged; 5,000 linear feet of deflecting Jetty built at Fig Island; three closing dams built between Elba and Long Islands, aggregating 3,249 linear feet, '82, 1146, 1148.

1882-'83. 8,935 linear feet of brush and stone dam built; 73,669 square yards log and brush mattress and 21,095 cubic yards riprap stone used in repairs to old work; 135,456 cubic yards material dredged, '83, 898.

1883-'84. 79,616 cubic yards material dredged from crossings between Spirit Island and Venus Point, also from channel at "The Wrecks;" Dam No. 23 strengthened; Wing-dam No. 25 completed; Wing-dams No. 14 and 29 commenced; 2,000 linear feet of Wing-dam No. 13 completed, '84, 1101.

1884-'85. 98,114 cubic yards material dredged at "The Wrecks" and the Upper Flats; log mattress apron placed upon Cross Tides Dam; Fig Island Jetty raised to 5 feet above low water; 6 wing-dams built at Upper and Lower flats and Long Island crossing; 2,700 linear feet of dam built between Quarantine Station and Oyster-Bed Beacon, '85, 1200.

1885-'86. 38,474 cubic yards material dredged from reaches between Savannah and Long Island; 1,600 feet of Dam No. 31 raised to mean low-water level; Cross Tides Dam repaired; closure dams at Philbuck's Cut and Big Gap brought up to mean high-water level, '86, 1091.

1886-'87. 121,093 cubic yards dredged from channels between Savannah and Tybee Knoll; 40,980 square yards of mattress, 39,053 cubic yards brush, and 17,241 cubic yards of stone placed in jetties and dams in their extension and repair, '87, 1152-1154.

Projects.

From 1826 to 1873, inclusive, \$449,473.68 was appropriated, including relief claims, and applied to closing channel between Hutchinson and Argyle islands and Fig Island, deepening channel over the wrecks, removing obstructions, and in dredging, '73, 734, 737.

By Col. Gillmore, 1873, for formation of a channel from Tybee Roads to Savannah City, with a high-water depth of 22 feet, to be accomplished by construction of a crib-dam closing the Cross Tides and a short bulkhead on Hutchinson's Island; widening the water-way at the city front and Fig Island, and by deepening, widening, and strengthening the channel by dredging at various points between the city and Tybee Roads. Estimated cost, \$481,320, '73, 741, 747; '80, 933; '82, 1142.

SAVANNAH RIVER, GA.—Continued.**Projects—Continued.**

Project modified in 1879 by a supplementary plan for the improvement of the north channel of the rivers from the head of the Elba Island to the head of Long Island by a low dam across the upper end of the south channel and by dams closing lateral channels and providing shore protection where necessary, '80, 948-957.

Board of Engineers of 1879 recommend approval of project, '80, 947.

The estimated cost of supplementary project covered by estimate for project of 1879, '80, 947; '82, 1143.

From 1874 to 1881, inclusive, \$714,132.96 was appropriated on the projects of 1873 and 1879, '82, 1145.

The project of 1-82 comprised those of 1873-'79, and provided for additional works with a view of rendering the improvement permanent by raising the dam at Cross Tides to ordinary high water; for dredging in reach of Front River from Cross Tides to city; increasing width of channel opposite city to 600 and 650 feet, construction of training-wall at Fig Island; elevation of south channel dam; the improvement of shallow reaches between Jones and Elba islands by construction of spur-jetties and wing-dams; closing by dams the cross channels between Elba and Cock's Pen Island; construction of jetty from Jones's Island, Red Light Beacon; and for protection of Saint Michael's Channel by similar work; also shore protection and dredging. Estimated cost, \$730,000, '82, 1143, 1144, 1145; '84, 1099; '86, 1087; '87, 1150.

Surveys.

River gauging, 1879, '80, 939.

Tidal observations, 1880, '80, 940.

Ordered by act of March 3, 1881. Made, 1882, under direction of Lieut. Col. Gillmore, '82, 1152.

From Cross Tides to the Bar ordered by act of August 5, 1886, '87, 1154.

MAPS.

River from Savannah City to Tybee Roads, '80, 940.

Chart of Cross Tides, '81, 1082.

Of river, '82, 1150; '83, 898; '84, 1106; '85, 1202.

Of river and harbor, '87, 1158.

SAYBROOK BAR, mouth of Connecticut River. (See CONNECTICUT RIVER.)**SCHUYLKILL RIVER, PA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 508.)

Appropriations.

1870-79.....	\$220,000
1880.....	40,000, '80, 581.
1881.....	40,000, '81, 762.
1882.....	25,000, '82, 747.
1884.....	25,000, '84, 812.
1886.....	18,750, '86, 831.

Total	368,750
1888	25,000, act of August 11, 1888.

Commerce.

Extensive arrangements for shipment of grain at Girard Point, '82, 749.

Contracts.

1879. F. Pidgeon, for removal of material, '80, 582.

1881. F. Pidgeon, for dredging, '81, 763.

1882. American Dredging Company, for dredging, at from 25 to 45 cents per cubic yard, '82, 748. National Dredging Company, for dredging, at 25 cents per cubic yard, '83, 615.

1884. National Dredging Company, for dredging, at 28 cents per cubic yard, '85, 838.

1886. American Dredging Company, for dredging, at 19 cents per cubic yard, '87, 801.

SCHUYLKILL RIVER, PA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 93; '81, 120; '82, 119; '83, 117; '84, 127; '85, 119; '86, 116; '87, 78.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 580; '81, 761.

Capt. W. Ludlow, 1882-'83. Report, '82, 746.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 613.

Maj. W. H. Heuer, 1884-'85. Report, '84, 811.

Lieut. Col. H. M. Robert, 1885-'— . Reports, '85, 837; '86, 830; '87, 800.

ASSISTANT.

T. Valentine. Report, '82, 748, 872.

Operations.

1879-'80. 61,073 cubic yards material dredged from the channel, '80, 580.

1880-'81. 8,500 cubic yards material dredged, '81, 761.

1881-'82. 62,573 cubic yards dredged, '82, 748.

1882-'83. 166,911 cubic yards material dredged from various points in the river, '83, 614.

1883-'84. 90,864 cubic yards material dredged from the channel between the mouth and Girard Point, '84, 812.

1884-'85. 52,730 cubic yards material dredged from the channel between Point Breeze and Girard Point piers, '85, 837.

1885-'86. 36,004 cubic yards material dredged from the channel between Point Breeze and Girard Point piers, '86, 830.

1886-'87. 90,581 cubic yards dredged from channel at Point Breeze, Yankee Point, and Penrose Reach, '87, 800.

Projects.

By Col. Kurtz, 1870, for the formation of a dredged channel 100 feet wide and 20 feet deep from the mouth to Gibson's Point; thence 18 feet deep to Chestnut Street Bridge in the city of Philadelphia. Estimated cost, \$257,700, '74, ii, 139, 140. Modified in 1875 to provide for a channel 300 feet wide and 24 feet deep between the mouth and Girard Point, '75, ii, 187; '76, i, 272; '79, 264.

Further modification in 1883 to increase the width of channel between mouth and Girard Point to 400 feet, with a depth of 24 feet, and from Girard and Gibson's Points a width of 250 feet and a depth of 20 feet at mean low water, '83, 614; '87, 78.

From 1870 to 1886, inclusive, \$368,750 was appropriated, when it was estimated that \$116,250 would be required to complete the project, '87, 801.

SCIOTO RIVER, OHIO—SURVEY OF.**Commerce.**

Necessity for protection against ice, '85, 1833.

Engineers.**CHIEF OF ENGINEERS.**

Report, '85, 285.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1832.

ASSISTANT.

Lieut. G. W. Goethals. Report, '85, 1832.

Physical Characteristics.

Description of river, '85, 1834.

Plans.

By Lieut. Col. Merrill, 1885, for the removal, by dredging, of the bar at the mouth of the river and the formation of an ice-harbor opposite Portsmouth. Estimated cost, \$47,000, '85, 1c36, 1839.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Merrill, '85, 1832.

SCITUATE HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 509.)

Appropriations.

1829-'79	\$1, 180
1880	7, 500, '80, 351.

SCITUATE HARBOR, MASS.—Continued.**Appropriations—Continued.**

1881.....	\$10,000, '81, 523.
1882.....	10,000, '82, 521.
1884.....	10,000, '84, 503.
1886.....	10,000, '86, 563.

Total 48,680

1888..... 5,000, act of August 11, 1888.

Contracts.

1881. C. H. Edwards, for granite, quarry grout, and bowlders, at \$1.56 and \$1.25 per ton, '81, 523.

1882. C. H. Edwards, for rubble-stone, '83, 444.

1886. H. W. Phillips, for rock blasting, at \$8.50 per cubic yard, '87, 525.

Boynton Brothers, for dredging, at 38 cents per cubic yard, '87, 525.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 70; '81, 75, 523; '82, 75; '83, 67; '84, 75; '85, 62; '86, 62; '87, 29.

BOARD OF ENGINEERS.

Convened at New York September 13, 1880, to report upon project for improvement of Scituate Harbor. Report, '80, 524. (Cols. Tower and Newton.)

ENGINEERS IN CHARGE.

Col. G. Thom, 1878-'83. Reports, '80, 350; '81, 521; '82, 519.

Maj. C. W. Raymond, 1883-'86. Reports, '83, 443; '84, 502; '85, 501.

Lieut. Col. G. L. Gillespie, 1886-'— . Reports, '86, 562; '87, 522.

Operations.

1881-'82. 10,024 tons rubble-stone placed in 470 linear feet of breakwater, '82, 520.

1882-'83. 4,953 tons of stone placed in breakwater, extending same 250 feet, '83, 444.

1883-'84. No operations for lack of funds, '84, 502.

1884-'85. 22,724 cubic yards of sand dredged from the harbor, '85, 501.

1885-'86. No operations, '86, 563.

1886-'87. 650 cubic yards rock removed and 18,326 cubic yards material dredged, '87, 524.

Projects.

By Lieut. Col. Thom, 1878, for formation of a harbor of refuge by the construction of two rubble-stone breakwaters, one extending from Cedar Point southeast 800 feet, the other from First Cliffs, on the south side of the entrance, northwest 730 feet, the works to be raised to a height of 4 feet above mean high-water plane; also for dredging between the breakwaters and within the harbor to give a general mean low-water depth of 10 feet, including an entrance channel 200 feet in width. Estimated cost, \$175,000, '79, 285, 286. Increased in 1881 and 1882 to \$290,000, '81, 522; '82, 520; '87, 523.

Recommendation by Board of Engineers, 1880, that area behind inner breakwater be excavated to depth of 12 feet and the channel to a depth of 12 feet, increasing to 15 feet at the south end of the outer breakwater, '81, 526; '87, 523.

Surveys.

Of channel, 1886, '86, 563.

MAPS.

'81, 522; '86, 562.

SCUPPERNONG RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 510.)

Appropriations.

1878-'79.....	\$4,000
1880.....	1,000, '80, 833.
1881.....	1,000, '81, 1001.
1884.....	2,000, '84, 1035.

Total 8,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 121; '81, 162; '82, 157; '83, 164; '84, 167; '85, 163; '86, 152.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'81. Report, '80, 831.

Capt. J. Mercur, 1881-'84. Reports, '81, 1000; '82, 1083; '83, 848.

Capt. F. A. Hinman, 1884-'— . Reports, '84, 1035; '85, 1044; '86, 969.

SCUPPERNONG RIVER, N. C.—Continued.**Operations.**

- 1879-'80. 206 logs and stumps removed; 4,830 cubic yards material dredged from the bar, '80, 532.
 1880-'81. 1,800 cubic yards material dredged at the "Devil's Elbow," '81, 1000.
 1881-'82. Cut-off commenced through "Rattlesnake Bend," '82, 1063.
 1882-'84. No operations for lack of funds, '83, 848; '84, 1035.
 1884-'85. Completion of improvements recommenced, '85, 1044.
 1885-'86. Cut-off No. 4 excavated to 9 feet low water, 136 feet long and 40 feet wide; the "Thoroughfare" and Cut-off No. 3 widened; 8 points rounded off; turning-basin at head of navigation enlarged; shoal at mouth of Collin's Canal removed; all dredging to 9 feet low water, '86, 969.

Projects.

- By Capt. Phillips, 1879, for improvement of the river by formation of a channel 60 feet wide and 9 feet deep at ordinary stage of water, by dredging, by cutting off projecting points at bends and removal of stumps, snags, and similar obstructions. Estimated cost, \$8,000, '79, 698, 699.

Surveys.**MAPS.**

- Upper portion, '86, 969.

SEBEWAING HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 510.)

Appropriations.

- 1875..... \$8,000
 1881..... 7,000, '81, 2251.

Contracts.

1880. T. M. Hubbell, for dredging, at 25 cents per cubic yard, '81, 2252.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 220, 221; '81, 209; '82, 294; '84, 308.

ENGINEER IN CHARGE.

- Maj. F. Harwood, 1879. Reports, '80, 2043, 2044; '81, 2251; '82, 2334; '84, 2079.

Operations.

- 1880-'81. 13,279 cubic yards material dredged from the channel, '81, 2251.
 1881-'82. 11,332 cubic yards material dredged from the channel, '82, 2334.

Projects.

- The original project of 1874 proposed the formation, by dredging, of a channel 100 feet wide and 6 feet deep from the mouth of the river to the 6-foot curve in the bay, at a cost of \$8,000, '75, i, 291, 292. This work was accomplished in 1876, '76, ii, 537.

- By Maj. Harwood, 1880, for excavation of a channel 50 feet wide and 7 feet deep to Saginaw Bay. Estimated cost, \$7,000, '80, 2045. Work completed in 1881, '82, 2334.

Surveys.

- Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Harwood, '80, 2044. Resurvey, to obtain a 12-foot channel, reported as unworthy of improvement, '84, 2079.

SECRETARY CREEK, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 510.)

Appropriations.

- 1880..... \$3,000, '80, 637.
 1881..... 3,000, '81, 878.

Commerce.

- Present and prospective commerce, '80, 637.

Contracts.

1880. American Dredging Company, for dredging, at 18 cents per cubic yard, '81, 878.
 1881. American Dredging Company, for dredging, at 20 cents per cubic yard, '81, 878.

SECRETARY CREEK, MD.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 103; '81, 136; '82, 132; '83, 137.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1879. Reports, '80, 636; '81, 877; '82, 852; '83, 678.

Operations.

1880-'81. 29,215 cubic-yards material dredged from channel and turning-basin, '81, 878.

1881-'83. No operations, '82, 852; '83, 678.

Projects.

By Lieut. Col. Craighill, 1880, for improvement of Secretary Creek by excavation of a 7-foot low-water channel 75 feet wide from the mouth up to the town of East New Market. Estimated cost, \$7,250, '80, 637.

Surveys.

Examination ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Craighill, '80, 636.

SHARK RIVER, N. J.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 90; '81, 115.

ENGINEER IN CHARGE.

Lieut. Col. N. Michler, 1880. Report, '81, 730.

ASSISTANT.

A. Doerflinger. Report, '81, 730.

Physical Characteristics.

Description of river, '81, 731.

Plans.

Lieut. Col. Michler, in 1880, did not consider it advisable to undertake any work of improvement, '81, 730.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Lieut. Col. Michler, '81, 730.

SHAWNEETOWN HARBOR, ILL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 284.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '85, 1828.

Plans.

In 1884 Lieut. Col. Merrill considered that since the object desired was the construction of a levee to protect the town against flood, the locality was not worthy of improvement, '85, 1828.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Col. Merrill, '85, 1828.

SHEBOYGAN HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 511.)

Appropriations.

1852-'79	\$183,448.91
1880	7,000.00, '80, 1921.
1881	25,000.00, '81, 2101.
1882	30,000.00, '82, 2150.
1884	28,000.00, '84, 1857.
1886	15,000.00, '86, 1671.
Total	288,448.91
1888	15,000.00, act of August 11, 1888.

SHEBOYGAN HARBOR, WIS.—Continued.**Contracts.**

1881. W. T. Casgrain, for pier extension, '81, 2101.
 1882. W. T. Casgrain, for pier extension, '82, 2150.
 1883. W. T. Casgrain, for crib superstructure construction, '83, 1691.
 1884. C. H. Harnea, for dredging, at 25 cents per cubic yard, '84, 1855. Truman & Cooper, for pier extension, '85, 2002.
 1886. Truman & Cooper, for pier extension, '87, 2049.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 206; '81, 278; '82, 274; '83, 282; '84, 282; '85, 305; '86, 299; '87, 265.

ENGINEERS IN CHARGE.

- Lieut. Col. H. M. Robert, 1875-'83. Reports, '80, 1920; '81, 2098, 2102; '82, 2149.
 Capt. F. A. Hinman, 1883-'84. Report, '83, 1690.
 Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1855; '85, 2001.
 Capt. C. E. L. B. Davis, 1886-'— Reports, '86, 1670; '87, 2047.

ASSISTANT.

- L. Y. Schermerhorn. Report, '81, 2104.

Operations.

History of work, '81, 2104.

- 1879-'80. 62 linear feet of old superstructure removed and rebuilt; 6,955 cubic yards sand dredged from channel between the piers, '80, 1920.
 1880-'81. 9,456 cubic yards material dredged on bar and between the piers, '81, 2099.
 1881-'82. 107 linear feet pile-pier and 50 linear feet of crib-pier built; 11,671 cubic yards material dredged from the bar and channel, '82, 2149.
 1882-'83. 250 linear feet of crib-pier and 24 linear feet of pile-pier built with superstructure for the same; 5,408 cubic yards material dredged from channel through the outer bar, '83, 1690.
 1883-'84. 250 linear feet crib-work with superstructure for same built and sunk in extension of the north pier; 6,425 cubic yards material dredged from the channel, '84, 1856.
 1884-'85. Crib construction commenced under Truman & Cooper's contract; 35,882 cubic yards material dredged from channel; 300 linear feet of north pier ripped, '85, 2001.
 1885-'86. South pier extended 350 feet; 95 feet of superstructure built, '86, 1670.
 1886-'87. 10,075 cubic yards material removed by United States dredge, '87, 2048.

Projects.

- In 1852 and 1864 \$20,000 was appropriated, which was applied in extension of work undertaken by city of Sheboygan, '76, ii, 374; '81, 2105.
 The project of 1866 proposed the extension of piers from the river mouth to the 12-foot curve in the lake with dredging to a depth of 12 feet in the channel between the piers, '66, i, 19, 24; iii, 12, 67, 75.
 In 1873 the project was modified by additional pier extensions and dredging so as to obtain a channel 16 feet deep, '73, 513; '81, 2105. Total amount appropriated from 1852 to 1880, inclusive, \$190,448.91.
 By Lieut. Col. Robert, 1881, for extension of piers to 20-foot curve in Lake Michigan, by construction of 1,055 linear feet pile-pier and 900 linear feet of crib-pier; also for excavation of channel 200 feet wide and 18 feet deep at the outer end, decreasing to 14 feet at the shore-line. Estimated cost, \$150,000, '81, 2104, 2105.
 Increased in 1884 to \$195,000, '84, 1856; '87, 2047.

Surveys.

- Of harbor, 1881, '81, 2102.

MAPS.

- '81, 2104.

SHEEPSHEAD BAY, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 513.)

Appropriations.

1880.....	\$3,000, '80, 515.
1881.....	5,000, '81, 652.
1882.....	3,000, '82, 672.
1884.....	5,000, '84, 734.
1886.....	5,000, '86, 745.

Total 21,000

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '87, 736.

SHEEPSHEAD BAY, N. Y.—Continued.**Contracts.**

1882. H. N. & A. J. Beardsley, for dredging, at 45 cents per cubic yard, '83, 567.

1884. Atlantic Dredging Company, for dredging, at 13½ cents per cubic yard, '85, 748.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 84; '81, 106; '82, 106; '83, 103; '84, 109; '85, 99; '86, 100; '87, 64.

ENGINEERS IN CHARGE.

Col. J. Newton, 1878-'83. Reports, '80, 515; '81, 651; '82, 670.

Lieut. Col. G. L. Gillespie, 1883-'86. Reports, '83, 566; '84, 732; '85, 740.

Lieut. Col. W. McFarland, 1886-'— . Reports, '86, 743; '87, 734.

Operations.

1883-'84. 20,000 cubic yards material dredged from the channel, '84, 733.

1884-'85. No operations, '85, 741.

1885-'86. 21,256 cubic yards material dredged from cut at Dead Horse Inlet, '86, 744.

1886-'87. No operations, '87, 736.

Projects.

By Lieut. Col. Newton, 1879, for improvement of Sheepshead Bay by diking and dredging. Estimated cost, \$100,000, '79, 400; '86, 743, 745.

In 1882 the project was changed to one for a cut 100 feet wide and 6 feet deep at mean low water, to connect Sheepshead Bay with Dead Horse Inlet, also for dredging interior channel. Estimated cost, \$34,200, '82, 671; '86, 744; '87, 735.

Surveys.

Ordered by act of June 18, 1878. Made under direction of Col. Newton, 1878, '79, 399.

MAPS.

'82, 670; '84, 732.

SHENANDOAH RIVER, VA. AND W. VA.—SURVEY OF.

(Continued from Vol. I, p. 513.)

Appropriations.

1880..... *\$15,000, '80, 661.

1881..... *2,500, '81, 904.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 106, 110; '81, 143; '82, 140; '83, 143; '84, 148; '85, 143; '86, 139; '87, 106.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1879-'85. Reports, '80, 661; '81, 903; '82, 912; '83, 699; '84, 927.

Lieut. Col. P. C. Haines, 1885-'—. Reports, '85, 957; '86, 891; '87, 925.

ASSISTANTS.

N. H. Hutton. Report, '80, 664.

J. Herron. Report, '80, 667, 670.

C. B. Fisk. Report, '80, 674.

Operations.

A plan was submitted by Lieut. Col. Craighill, in 1880, for improvement of the Shenandoah from Port Republic to Harper's Ferry by slackwater navigation, at an estimated cost of \$72,250, but title could not be secured by the Government to the necessary lands until 1883, '83, 699. Still further legal difficulties arose, '84, 927, and up to the end of the fiscal year 1887 operations had not been commenced, '87, 925.

Projects.

By Lieut. Col. Craighill, 1880, for improvement of the Shenandoah River, by slackwater navigation, securing a 20-foot width and 1½-foot depth at low stage of water from Port Republic to Harper's Ferry, by rebuilding the locks, dams, and chutes of the navigation company. Estimated cost, \$72,250, '80, 666, 667. (See proviso of acts of 1880-'81, '85, 957.)

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Craighill, '80, 662.

* See Proviso, '85, 957

SHIP ISLAND HARBOR, MISS.—EXAMINATION OF OUTLET OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 189; '82, 186.

ENGINEER IN CHARGE.

Capt. A. N. Damrell. Report, '82, 1321.

ASSISTANT.

T. L. Harrison. Report, '82, 1321.

Plans.

In 1831 Capt. Damrell did not consider that any improvement to the outlet of the harbor was needed, '82, 1321.

Surveys.

Examination ordered by act of June 14, 1880. Made under direction of Capt. Damrell, '82, 1321.

SHOAL HARBOR AND COMPTON'S CREEK, N. J.—SURVEY OF**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 122.

ENGINEER IN CHARGE.

Maj. G. L. Gillespie. Report, '84, 770.

ASSISTANT.

A. Doerflinger. Report, '84, 771.

Physical Characteristics.

Description of locality, '84, 770.

Plans.

By Maj. Gillespie, 1884, for the formation of a channel in the creek, by dredging, 150 feet wide and 5 feet deep at low water between the harbor and the bay. Estimated cost, \$64,140, '84, 771, 773.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Maj. Gillespie, '84, 770.

SHOAL WATER BAY, WASH. (See BAKER'S BAY.)**SHREVEPORT, LA. (See RED RIVER, LA.)****SHREWSBURY RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 513.)

Appropriations.

1852-79.....	\$48,500
1880.....	30,000, '80, 543.
1881.....	86,000, '81, 699.
1882.....	30,000, '82, 693.
1886.....	10,000, '86, 760.

Total	204,500
1888	10,000, act of August 11, 1888.
Appropriations prior to 1880, '80, 543.	

Commerce.

Increase in commerce consequent upon improvement, '84, 745.

Contracts.

1880. J. A. Bouker, for crib and training dike construction, '80, 542. J. Kelley, for pile-dike construction, '81, 700.

SHREWSBURY RIVER, N. J.—Continued.**Contracts—Continued.**

1881. W. H. Wood, for pile-dike construction, '81, 700. E. Brainard, jr., for dredging, at 34 cents per cubic yard, '82, 693. W. H. Wood, for pile dike construction, '82, 693. W. H. Wood, for dredging, at 44 cents per cubic yard, '82, 694. E. Brainard, jr., for dredging, at 42 cents per cubic yard, '82, 694.
1882. E. Brainard, jr., for dredging, at 36 cents per cubic yard, and diking at \$5.50 per linear foot, '83, 578.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 87; '81, 110; '82, 111; '83, 107; '84, 114; '85, 105; '86, 103; '87, 74.

BOARD OF ENGINEERS.

The Board of Engineers, 1880, concur with Lieut. Col. Michler in the proposed change of channel from the west to the east side of Island A, '81, 704.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1878-'82. Reports, '80, 542; '81, 697, 701.

Lieut. Col. G. L. Gillespie, 1882-'86. Reports, '82, 690; '83, 576; '84, 751; '85, 751.

Lieut. Col. W. McFarland, 1886. Report, '86, 756.

Lieut. G. McC. Derby, 1887-'—. Report, '87, 778.

Operations.

1879-'80. 1,830 feet of west dike completed, '80, 542.

1880-'81. 24,017 cubic yards sand dredged from flat at South Branch entrance, '81, 698.

1881-'82. 89,566 cubic yards material dredged from north and south branches and main stem; 4,021 linear feet pile-dike built, '82, 690, 691, 692.

1882-'83. 94,311 cubic yards material dredged from north and south branches and main stem; 603 linear feet of diking built, '83, 577.

1883-'84. 31,415 cubic yards material dredged from South Branch Channel, '84, 745.

1884-'86. No operations, '85, 751; '86, 759.

1886-'87. 1,357 linear feet of Dike B riprapped, '87, 778.

Physical Characteristics.

Description of the river, '86, 756.

Projects.

The project of 1870 proposed dredging channels through the shoals in both branches of the river, at an estimated cost of \$14,000, '71, 703. This amount was appropriated in 1871 with an additional \$5,000 in 1873, but the improvement was not permanent, '86, 104.

In 1879 the existing project was adopted for securing, by dredging and by contracting the wider portions of the river by the use of dikes, channels 6 feet deep at mean low water and from 200 to 300 feet wide, and extending from the 6-foot curve at the mouth in Sandy Hook Bay up to the 6-foot curves on both branches of the river in the bays above. Estimated cost, as modified by Board of Engineers, \$142,066, '79, 408, 411; '86, 757.

In 1880 Col. Michler proposed the change of the proposed channel from the west to the east side of Island A in the South Branch, '81, 701. Concurred in by Board of Engineers, 1880, '81, 704.

The amount appropriated from 1852 to 1886, inclusive, was \$204,000. In 1887 the total estimated cost was revised to \$254,562, '87, 781.

Surveys.**MAPS.**

'81, 698; '82, 694; '87, 780.

SIoux CITY, IOWA. (See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**SIPSEY RIVER, ALA.—EXAMINATION OF.**

(Continued from Vol. I, p. 515.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140; '81, 189.

ENGINEER IN CHARGE.

Capt. A. N. Damrell, 1879. Report, '81, 1221.

SIPSEY RIVER, ALA.—Continued.**Plans.**

In 1880 Capt. Damrell stated that there was no commerce of importance on the river, '81, 1221.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Damrell, '81, 1221.

SIUSLAW BAY, OREG.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 242; '81, 332; '87, 330.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1879. Report, '81, 2617.

Capt. C. F. Powell, 1886. Report, '87, 2433.

ASSISTANTS.

J. S. Polhemus. Report, '81, 2618.

Lieut. E. Burr. Report, '87, 2494.

Physical Characteristics.

Description of river and surrounding country, '81, 2617; '87, 2493.

Surveys.

The locality deemed worthy of a survey, '81, 2618.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Capt. Powell, '87, 2493.

Capt. Powell reports that the river and bar are unworthy of improvement, '87, 2494.

SKAGIT, STEILACQUAMISH, NOOTSACK, SNOHOMISH, AND SNOQUALMIE RIVERS, WASH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 515.)

Appropriations.

1880..... '\$2,500, '82, 2681.

1882..... 20,000, '82, 2685.

1884..... 10,000, '84, 2275.

1886..... 10,000, '86, 2608.

Total..... 42,500

1888..... 15,000, act of August 11, 1888.

Statement of appropriations, '87, 2471.

Commerce.

Amount to be influenced by improvement, '84, 2275.

Contracts.

1883. Cashen, McKay & Co., for wooden-hull snag-boat construction, '83, 2275.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 242; '81, 332; '82, 333; '83, 333; '84, 340; '85, 367; '86, 364; '87, 329.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1880-'82. Report, '81, 2608, 2611, 2614.

Capt. C. F. Powell, 1882-'— . Reports, '82, 268; '83, 1998; '84, 2274; '85, 2403; '86, 2007; '87, 2490.

ASSISTANT.

R. A. Habersham. Report, '81, 2610, 2613, 2615.

Operations.

1883-'7 7. 105 snags removed on the Snohomish River, '84, 2274.

1884-'85. 1,202 snags, logs, etc., removed from the Steilacquamish and Skagit rivers; extensive log jam below Nootsack Crossing removed, '85, 2403.

1885-'86. No operations for lack of funds, '86, 2007.

1886-'87. 847 snags and 97 trees removed from lower Snohomish and Nootsack rivers, '87, 2490.

* For Skagit River alone.

SKAGIT, STEILAQUAMISH, NOOTSACK, SNOHOMISH, AND SNOQUALMIE RIVERS, WASH.—Continued.**Physical Characteristics.**

Description of river and surrounding country, '81, 2613.

Private and Corporate Work.

Work on the Nootsack Jam done by contractor's party under local citizens' committee, '85, 2404; '86, 2007.

Projects.

By Maj. Gillespie, 1881, for construction of snag-boat and maintenance of same for or one year. Estimated cost, \$25,000, '81, 26 2. Increased \$,000 in 1882, '82, 2686, and \$10,000 in 1884, '84, 2275. Estimate for completion, 1886, \$23,000, '86, 2008.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Gillespie, '81, 2611.

Examination of Steilaquamish River ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Gillespie, '81, 2608.

Examination of Nootsack River ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Gillespie, '81, 2611.

Examination of Snohomish River ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Gillespie, '81, 2614.

SKIPANON RIVER, OREG. (See YOUNG'S, LEWIS, AND CLARKE'S RIVERS.)**SKIPTON CREEK, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 150; '82, 144; '85, 137.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '82, 948.

W. F. Smith, U. S. Agent. Report, '85, 907.

Plans.

By Lieut. Col. Craighill, 1882, for the formation of a dredged channel through the bar at the mouth 10 feet wide and 6 feet deep at low water, with a turning-basin at Skipton Landing 300 by 200 feet. Estimated cost, \$15,000, '82, 949; '85, 908.

Surveys.

Examination ordered by act of March 3, 1881. Made under direction of Lieut. Col. Craighill, '82, 948.

Examination ordered by act of July 5, 1884. Made under direction of W. F. Smith, '85, 907.

SLAUGHTER CREEK, MD.—SURVEY OF.

(Continued from Vol. I, p. 515.)

Engineers.**CHIEF OF ENGINEERS.**

Report, '80, 110.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1879. Report, '80, 739.

Physical Characteristics.

Description of creek and adjacent country, '80, 740.

Plans.

By Maj. Craighill, 1880, for securing a channel below the bridge at Ferry Point 7 feet deep at mean low water. Estimated cost, \$7,250, '80, 740.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Craighill, '80, 739.

SMITH'S MILLS AND WHITE OAK RIVER—EXAMINATION OF SOUND BETWEEN.

(See BEAUFORT AND NEW RIVER, N. C.)

SMITH'S RIVER, CAL.—EXAMINATION OF MOUTH OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 324.

ENGINEER IN CHARGE.

Capt. A. H. Payson. Report, '87, 2450, 2452.

ASSISTANT.

A. Boschke. Report, '87, 2451.

Plans.

In 1887 Capt. Payson considered that the cost of the improvement would not be justified by the interests served, '87, 2450, 2453.

Surveys.

Examination ordered by act of August 5, 1886. Made under the direction of Capt. Payson, '87, 2450.

SNAGS, REMOVAL OF, FROM UPPER MISSISSIPPI RIVER.

(See MISSISSIPPI RIVER, UPPER.)

SNAKE RIVER, WASH.—SURVEY OF, ABOVE LEWISTON.

(See also COLUMBIA RIVER, UPPER.)

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 322; '82, 324; '85, 372.

ENGINEERS IN CHARGE.

Capt. C. F. Powell. Report, '82, 2716.

Maj. W. A. Jones. Report, '85, 2440.

ASSISTANTS.

Lieut. T. W. Symons. Report, '82, 2718.

F. J. Carrel. Report, '85, 2441.

Physical Characteristics.

Description of river, '82, 2716, 2718; '85, 2441.

Plans.

By Capt. Powell, 1881, for the improvement of the river from Lewiston to Salmon River by the removal of rock, boulders, and gravel, so as to give navigation from 4 to 6 months of the year. Estimated cost, \$32,604, '82, 2718, 2722.

Surveys.

From Lewiston to mouth of Salmon River ordered by act of March 3, 1881, '81, 332. Made under direction of Capt. Powell, 1881, '82, 2716.

Between Lewiston and mouth of Boise River ordered by act of July 5, 1884. Made under direction of Maj. Jones, 1884, '85, 2440.

SNOHOMISH RIVER. (See SKAGIT RIVER, WASH.)**SNOQUALMIE RIVER. (See SKAGIT RIVER, WASH.)**

SODUS HARBOR (GREAT), N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 516.)

Appropriations.

1829-79	\$343,771.80
1880	3,000.00, '80, 2210.
1881	5,000.00, '81, 2442.
1882	25,000.00, '82, 2448.
1884	10,000.00, '84, 2441.
1886	16,875.00, '86, 1890.

Total 403,646.80

1888 24,000.00, act of August 11, 1888.

List of appropriations previous to 1880, '81, 2441.

Contracts.

1881. C. F. Dunbar, for dredging, at 23 cents per cubic yard, '81, 2443.

1882. G. Kellogg & Co., for pier construction, '83, 1946.

1883. A. J. Packard, for iron, '83, 1946.

1884. A. F. Chapman, for pier extension, '86, 1890.

1886. W. S. Malcolm, for dredging, at 16 cents per cubic yard, '87, 2377.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 231; '81, 316; '82, 312; '83, 320; '84, 324; '85, 349; '86, 344; '87, 309.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1875-'83. Reports, '80, 2209; '81, 2441; '82, 2446.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1945; '84, 2140.

Capt. E. Maguire, 1885-'87. Reports, '85, 2274; '86, 1890.

Capt. C. F. Palfrey, 1887-'—. Report, '87, 2376.

Operations.

1879-'80. 825 linear feet west pier superstructure rebuilt, '80, 2209.

1880-'81. 13,000 cubic yards sand dredged, '81, 2441.

1881-'82. 29,000 cubic yards sand dredged; 100 linear feet catch-sand fence built, '82, 2446, 2447.

1882-'83. Foundations for cribs and construction of same in progress; 1,245 cubic yards material dredged, '83, 1945.

1883-'84. 330 linear feet pier extension built; 1,991 cubic yards material dredged, '84, 2140.

1884-'85. 200 linear feet pier extension completed, '85, 2275.

1885-'86. 200 linear feet pier superstructure completed; sand fences repaired, '86, 1890.

1886-'87. 13,224 cubic yards material dredged and piers extensively repaired, '87, 2377.

Projects.

After an aggregate of appropriations amounting to \$351,771.80 Maj. McFarland proposed, in 1881, the extension of east and west piers to 15-foot curve and deepening the channel to 15 feet by dredging. Estimated cost, \$100,000, '81, 2442; '87, 2376.

Surveys.**MAPS.**

'81, 2442.

SODUS HARBOR (LITTLE), N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 518.)

Appropriations.

1852-79	\$194,441.77
1880	20,000.00, '80, 2211.
1881	20,000.00, '81, 2445.
1882	25,000.00, '82, 2449.

SODUS HARBOR (LITTLE,) N. Y.—Continued.**Appropriations—Continued.**

1884..... \$10,000.00, '84, 2142.
 1886..... 12,500.00, '86, 1892.

Total 281,941.77

1888..... 16,000.00, act of August 11, 1888.

List of appropriations prior to 1880, '81, 2443.

Contracts.

1879. C. F. Dunbar, for dredging, at 18 cents per cubic yard, '80, 2212.

1880. W. D. Taylor, for iron, '81, 2446. R. J. Myers and H. C. Post, for timber, '81, 2446.

1881. D. W. McConnell, for dredging, at 17½ cents per cubic yard, '81, 2446. R. J. Myers and H. E. Post, for timber, '81, 2446. W. D. Taylor, for iron, '81, 2446.

• 1882. Kelly & Bennerman, for pier extension, '83, 1947. A. J. Packard, for iron, '83, 1946.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 318; '82, 312; '83, 321; '84, 325; '85, 350; '86, 344; '87, 310.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1875-'83. Reports, '80, 2210; '81, 2443; '82, 2448.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1946; '84, 2142.

Capt. E. Maguire, 1885-'87. Reports, '85, 2276; '86, 1891.

Capt. C. F. Palfrey, 1887-'— Report, '87, 2379.

Operations.

1879-'80. Filling placed in east pier; 1,000 linear feet west pier superstructure built; 9,678 cubic yards material dredged, '80, 2210.

1880-'81. Work on piers and dredging continued, '81, 2444.

1881-'82. East pier extended 757 feet, and west pier 242; 40,000 cubic yards sand dredged from channel between piers, '82, 2448.

1882-'83. East pier extended 360 feet, and west pier 150 feet, '83, 1946.

1883-'84. West pier extended 120 feet, east pier 240 feet, '84, 2142.

1884-'85. 100 linear feet crib-work added to west pier and riprap foundation laid for remainder of extension, '85, 2277.

• 1885-'86. West pier extended 100 feet and 200 linear feet superstructure built, and stone dike built between end of east breakwater and shore, '86, 1891.

1886-'87. No operations, '87, 2380.

Projects.

The earliest plan of improvement was submitted in 1829 by Capt. T. W. Maurice.

The first appropriation was made in 1852, '74, i, 256; '76, ii, 591. The present project, adopted in 1881, was an expansion of the earlier projects, and proposed to furnish a channel of entrance not less than 15 feet deep by the closure of one side of the bay by a lateral pier of crib-work filled with stone, in connection with two parallel piers extending into the lake, '79, 1731; '81, 2444; '87, 2379. The total amount appropriated from 1852 to 1886, inclusive, was \$281,941.77. Amount estimated to complete project, \$32,500, '86, 344, 1892; '87, 2381.

Surveys.**MAPS.**

'81, 2446.

SOUTH AMBOY, N. J. (See AMBOY, N. J.)

SOUTH BEACH, MASS. (See EDGARTOWN HARBOR AND SOUTH BEACH.)

SOUTH FORKED DEER RIVER, TENN. (See DEER RIVER, TENN.)

SOUTH FORK, KY. (See KENTUCKY RIVER, SOUTH FORK.)

SOUTH HAVEN HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 521.)

Appropriations.

1867-'79	\$149,500
1880	5,000, '80, 2029.
1881	5,000, '81, 2236.
1882	10,000, '82, 2317.
1884	7,500, '84, 1993.
1886	5,000, '86, 1771.

Total 182,000

1888 10,000, act of August 11, 1888.

Contracts.

1880. Squire & White, for dredging, at 25 cents per cubic yard, '80, 2028.

1882. Squire & White, for dredging, at 19 cents per cubic yard, '83, 1831.

1887. H. B. Herr & Co., for crib construction, '87, 2199.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 218; '81, 296; '82, 290; '83, 298; '84, 299; '85, 321; '86, 315; '87, 283.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1872-'80; '80, 2007.

Maj. F. Harwood, 1880-'82. Reports, '80, 2028; '81, 2235.

Maj. D. P. Heap, 1882-'83. Report, '82, 2317.

Capt. D. W. Lockwood, 1883— Reports, '83, 1830; '84, 1991; '85, 2085; '86, 1770; '87, 2198.

Operations.

1880-'81. 11,571 cubic yards material dredged from channel between lake and inner harbor; extensive repairs to plant, '81, 2235, 2236.

1881-'82. 661 linear feet of plank beam revetment and 534 linear feet of catch-sand fence built, '82, 2317.

1882-'83. Repairs to south pier, revetment, and plank beam wall, 85 linear feet plank beam revetment, and 592 linear feet sand fence built on north side; 17,449 cubic yards material dredged from "middle ground," '83, 183.

1883-'84. 1,905 cubic yards material dredged from channel between the piers, '84, 1992.

1884-'85. 447 linear feet of north pier and 210 linear feet of south pier repaired, '85, 2085.

1885-'86. 29,865 cubic yards material dredged from channel between the piers, '86, 1770.

1886-'87. Site dredged and foundation piles driven for 50 linear feet of crib-work and 14 courses of same built, '87, 2198.

Projects.

The original project of 1866 proposed the extension of two parallel piers 120 feet apart from the mouth of the river to the 12-foot curve in the lake, the protection of the river banks by sheet-pile revetment, and dredging a channel 12 feet deep between the piers and across the outer bars. Estimated cost, \$128,288.47, '66, iv, 148; '74, i, 192; '79, 1628.

In 1879 the project was modified, increasing the channel depth to 14 feet, '79, 1628; '81, 2236. Total amount appropriated from 1867 to 1886, inclusive, \$182,000. Amount estimated to complete project in 1886, \$77,500, '86, 316; '87, 2199.

Surveys.**MAPS.**

'80, 2028; '84, 1992.

SOUTHOLD HARBOR, N. Y.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 100.

ENGINEER IN CHARGE.

Maj. J. W. Barlow, 1882. Report, '84, 686.

Physical Characteristics.

Description, '84, 686.

SOUTHOLD HARBOR, N. Y.—Continued.**Plans.**

By Maj. Barlow, 1834, for excavation of a channel 100 feet wide and 10 feet deep from landing to deep water, a distance of 500 feet. Estimated cost, \$4,000, '84, 686.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1884, under direction of Maj. Barlow, '84, 686.

SOUTHPORT HARBOR, CONN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 523.)

Appropriations.

1836-'79	\$13,000
1880	2,500, '80, 465.
1881	2,500, '81, 608.
1882	3,000, '82, 621

Total 21,000

Statement of appropriations, '87, 616.

Contracts.

1881. J. M. Seward, for dredging, at 19 cents per cubic yard, '81, 609. J. McDermott, for dredging, at 33 cents per cubic yard, '82, 622.

1882. J. H. Fenner, for dredging, at 32 cents per cubic yard, '83, 522.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 79; '81, 94; '82, 95; '83, 91; '84, 97; '85, 86; '86, 87; '87, 50.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1875-'83. Reports, '80, 464; '81, 607; '82, 620.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 521; '84, 653; '85, 655.

Lieut. Col. D. C. Houston, 1886-'— . Reports, '86, 648; '87, 615.

Operations.

1879-'80. No operations.

1880-'81. 11,294 cubic yards material dredged from the channel, '81, 607.

1881-'82. 6,768 cubic yards material dredged, '82, 621.

1882-'83. 8,390 cubic yards material dredged, '83, 522.

1883-'87. No operations; project completed, '84, 653; '85, 656; '86, 648; '87, 615.

Projects.

The earliest project, 1827, provided for a stone breakwater extending southward 1,420 feet on the east side of the harbor, and a dike extending northward 1,450 feet from the head of the breakwater. This work was completed in 1838 at a cost of \$10,587.23; '70, 453; '86, 648.

In 1875 the breakwater was repaired and raised 2 feet, '76, i, 53, 229; '86, 648.

In 1876 the project was modified to provide for dredging a channel 50 feet wide and 4 feet deep at low water from Long Island Sound to the wharves at Southport.

In 1877 the project was amended to provide for 100 feet width, '78, 406; '79, 59, 355; '86, 648.

The project was practically completed in 1883, '83, 522; '84, 653; '86, 648.

Total appropriations, 1829 to 1882, inclusive, \$31,587.23, '86, 649; '87, 616.

Surveys.**MAPS.**

'82, 620; '86, 648.

SOUTHPORT HARBOR, WIS. (See KENOSHA HARBOR.)**SOUTH RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 524.)

Appropriations.

1871-'79	\$20,000
1880	40,000, '80, 519.
1881	6,000, '81, 662.

SOUTH RIVER, N. J.—Continued.**Appropriations—Continued.**

1882..... \$10,000, '82, 679.
 1886..... 5,000, '86, 780.

Total 81,000
 1888..... 5,000, act of August 11, 1888.

Commerce.

Commercial statistics, '86, 780; '87, 774.

Contracts.

1882. H. Du Bois & Sons, for wharf removal and reconstruction, dike construction, and dredging, '83, 554.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 84, 85; '81, 106; '82, 108; '83, 100; '84, 120; '85, 112; '86, 108; '87, 72.

ENGINEERS IN CHARGE.

Col. J. Newton, 1879-'84. Reports, '80, 519; '81, 660; '82, 677; '83, 553.

Lieut. Col. G. L. Gillespie, 1884-'86. Reports, '84, 760; '85, 764.

Lieut. Col. W. McFarland, 1886. Report, '86, 777.

Lieut. G. McC. Derby, 1886-'— Report, '87, 773.

ASSISTANT.

R. H. Talcott. Report, '80, 520.

Operations.

1882-'83. Wharf at Raritan and South River Canal junction rebuilt; 1,779 linear feet of dike built, '83, 554.

1883-'84. 3,117 linear feet of diking built; 2,222 cubic yards material dredged from shoal; 3,173 cubic yards rock blasted from shoal at Whitehead's sand dock, '84, 760, 761.

1884-'85. 1,200 cubic yards broken stone placed in dike at mouth of canal, '85, 765.

1885-'87. No operations, '86, 779; '87, 773.

Projects.

By Col. J. Newton, 1879, for improvement of South River by rectification of the entrance to the artificial channel or canal into the Raritan River; closing the South River below Petit's brick-yard, increasing by means of dikes and dredging the depth to 8 feet at mean low water up to Washington, 6 feet to Bissett's, and 4 feet to old bridge, involving the construction of 15,200 linear feet of dike, 3,200 linear feet of half-dike and dredging. Estimated cost, \$194,695, '80, 522, 523; '87, 773.

Surveys.

Examination ordered by act of March 3, 1879. Made, 1880, under direction of Col. Newton, '80, 519.

MAPS.

'82, 678; '85, 764.

SPRING CREEK, N. Y.

Examination ordered by act of August 5, 1886, '87, 317.

STAMFORD HARBOR, CONN.—IMPROVEMENT OF.**Appropriations.**

1886..... \$10,000, '87, 619.
 1888..... 5,000, act of August 11, 1888.

Commerce.

Commercial statistics, '84, 671.

Contracts.

1887. Hartford Dredging Company, for dredging, at 15 $\frac{1}{10}$ cents per cubic yard, '87, 619.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 99; '87, 51.

ENGINEERS IN CHARGE.

Maj. J. W. Barlow. Report, '84, 670, 672.

Lieut. Col. D. C. Houston, 1886-'— Report, '87, 61

ASSISTANT.

H. N. Babcock. Report, '84, 672.

STAMFORD HARBOR, CONN.—Continued.**Operations.**

1886-'87. 23,616 cubic yards material dredged from channel between bay and the bridge, '87, 619.

Projects.

By Maj. Barlow, 1883, for the formation of a dredged channel 5 feet deep at mean low water, extending from the Oliver Street Bridge across Mill Creek to the bay. Estimated cost, \$20,000, '84, 672; '87, 619.

Surveys.

Ordered by act of August 2, 1882. Made under direction of Maj. Barlow, '84, 670.

MAPS.

'87, 618.

STATEN ISLAND AND NEW JERSEY—IMPROVEMENT OF CHANNEL BETWEEN.

(See also ARTHUR KILL.)

(Continued from Vol. I, p. 525.)

Appropriations.

1874-'79	\$75,000
1880	29,000, '80, 540.
1882	40,000, '82, 689.
1884	10,000, '84, 744.
1886	15,000, '86, 792.

Total 169,000

1888 15,000, act of August 11, 1888.

Statement and application of appropriations, '86, 792; '87, 747.

Commerce.

Advantages resulting from improvement, '82, 690.

Importance of improvement, '85, 750.

Contracts.

1880. Morris & Cumings Dredging Company, for dredging, at 19½ cents per cubic yard, '81, 692. Completed, '82, 687.

1883. Morris & Cumings Dredging Company, for dredging, at 23½ cents per cubic yard, '83, 576. Completed, '83, 575.

1885. E. Brainard and T. H. Benton, for dredging, at 20 cents per cubic yard '85, 750. Completed, '85, 749.

1887. T. H. Benton, for dredging, at 28½ cents per cubic yard, '87, 743. History of operations, '87, 746.

Engineers.**CHIEF OF ENGINEERS**

Reports, '80, 86; '81, 109, 693; '82, 110; '83, 106; '84, 113; '85, 104; '86, 110; '87, 65.

BOARD OF ENGINEERS.

For river and harbor improvement. Report, '81, 694.

ENGINEERS IN CHARGE.

Col. J. Newton, 1873-'80. Report, '80, 540.

Lieut. Col. N. Michler, 1880-'81. Reports, '80, 540; '81, 691.

Lieut. G. L. Gillespie, 1881-'86. Reports, '82, 687; '83, 575; '84, 742; '85, 749.

Lieut. Col. W. McFarland, 1886-'—. Reports, '86, 788; '87, 743.

Operations.

1879-'80. 101,368 cubic yards of material dredged, '81, 691.

1881-'82. 116,931 cubic yards of material dredged, '82, 687.

1882-'83. 158,637 cubic yards of material dredged, '83, 575.

1884-'85. 44,953 cubic yards of material dredged, '85, 749.

1885-'86. No operations for lack of funds, '86, 791.

1886-'87. 31,261 cubic yards material dredged from the channel, '87, 747.

Physical Characteristics.

Description of channel, '86, 788; '87, 743.

STATEN ISLAND AND NEW JERSEY—Continued.**Projects.**

By Board of Engineers, 1880 (in extension of previous project of 1873 and 1875), for improvement of a channel between Staten Island and New Jersey, east from Elizabethport, to the deep water of the Kill Von Kull, 400 feet wide, the middle 200 feet to be 13 feet and the remainder of channel 12 feet deep at mean low water; in addition, if found necessary, parallel dikes to be built on opposite sides of the channel at two places. Estimated cost, \$185,705, '81, 109, 692, 695; '86, 790. (Cols. Tower and Newton and Lieut. Col. Abbot.) Estimate increased to \$210,000, '87, 745.

Surveys.**MAPS.**

'81, 696.

STAUNTON RIVER, VA. (between Brook Neal and mouth of Pig River)—IMPROVEMENT OF.

(Continued from Vol. I, p. 526.)

Appropriations.

1879.....	\$5,000
1882.....	2,000, '83, 828.
1886.....	5,000, '86, 925.

Statement of appropriations, '87, 952.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 158; '82, 154; '83, 158; '84, 160; '85, 151; '86, 146; '87, 112.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1879—'. Reports, '82, 1 047; '83, 826; '84, 990; '85, 992; '86, 924; '87, 951.

Operations.

1883-'84. 535 cubic yards rock removed from the channel, '84, 999.
 1884-'86. No operations, '85, 992; '86, 925.
 1886-'87. Channel 14 feet wide and 1½ feet deep opened through Pocket Shoal No. 3, '87, 952.

Physical Characteristics.

Description of the river, '82, 1047.

Projects.

By S. T. Abert, 1882, for improvement of Staunton River from Brook Neal to mouth of Pig River, a distance of 52 miles, by construction of spur-dikes and rock excavation, chiefly to reduce the slope of the river for batteaux navigation. Estimated cost, \$40,087, '82, 1048, 1052; '87, 952.

Surveys.

Of Staunton River, from Brook Neal to mouth of Pig River, ordered by act of March 3, 1881. Made, 1882, under direction of S. T. Abert, '82, 1047.

MAPS.

Profile from Brook Neal to Roanoke Station, '86, 923.

STAUNTON RIVER, VA. (between Randolph Station and Brook Neal)—IMPROVEMENT OF.**Appropriations.**

1880.....	\$7,500, '80, 787.
1881.....	5,000, '81, 977.
1882.....	5,000, '82, 1046.
1884.....	5,000, '84, 998.
1886.....	5,000, '86, 923.

Total..... 27,500

1888. Between Randolph Station and Pig River. 5,000, act of August 11, 1888.

Statement of appropriations, '87, 951.

Commerce.

Trade and commerce, '80, 787.

Contracts.

1879. Mosely & Canada, for timber, '80, 787.

STAUNTON RIVER, VA.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 116; '81, 156; '82, 152; '83, 158; '84, 160; '85, 150; '86, 145; '87, 111.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1878.— Reports, '80, 780; '81, 976; '82, 1044; '83, 824; '84, 908; '85, 989; '86, 922; '87, 950.

ASSISTANT.

J. H. Gill. Report, '80, 781.

Operations.

1879-'80. Derrick-boat, derrick, quarter-boat, and two stone scows built, '80, 787.

1880-'81. 1,306 cubic yards rock blasted from the channel, '81, 977.

1881-'82. 4,625 cubic yards blasted and loose rock removed; 12 crib-dams built of an aggregate length of 522 feet, '82, 1045.

1882-'83. 307 cubic yards rock, 7 snags, and 35 trees removed, '83, 825.

1883-'84. No operations, '84, 998.

1884-'85. 18 miles of river placed in navigable condition, '85, 990.

1885-'86. 757 cubic yards rock removed from channel, '86, 923.

1886-'87. 194 cubic yards solid rock and 112 cubic yards of loose rock and gravel removed from channel, '87, 950.

Physical Characteristics.

Description of the river, '82, 1047.

Projects.

By S. T. Abert, 1879, for improvement of Staunton River from Brook Neal to Roanoke Station, a distance of 32 miles, by rock removal and spur-dike and dam construction, so as to give a low-water channel of 2 feet depth and not less than 35 feet wide. Estimated cost, \$68,708.40, '80, 783, 786; '87, 950.

Surveys.

From Brook Neal to Roanoke Station, '87, 950.

MAPS.

'80, 786.

STEEL'S BAYOU, MISS.—IMPROVEMENT OF.**Appropriations.**

1884..... \$2,500, '85, 1523.

1886..... 2,500, '86, 1361.

1888..... 2,500, act of August 11, 1888.

Commerce.

Cotton production, '84, 1360, 1362.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 227; '85, 241; '86, 235; '87, 200.

ENGINEERS IN CHARGE.

Maj. A. M. Miller, 1882-'85. Report, '84, 1360.

Capt. E. Bergland, 1885-'87. Reports, '85, 1522; '86, 1363.

Capt. J. H. Willard, 1887.— Report, '87, 1476.

ASSISTANT.

P. C. Montgomery. Report, '84, 1361.

Operations.

1884-'85. 2,993 trees, snags, and logs cut and removed, '85, 1523.

1885-'86. No operations, '86, 1364.

1886-'87. Removal of obstructions from 40 miles of channel, '87, 1477.

Physical Characteristics.

Description, '84, 1360.

Projects.

By Maj. Miller, 1883, for improvement of the bayou from its mouth to Swan Lake by removal of obstructions at low water, giving a seven months' navigable channel. Estimated cost, \$14,960, '84, 1362.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Miller, '84, 1360.

STOCKHOLM, WIS.—HARBOR OF REFUGE AT.

(See LAKE PEPIN, MISSISSIPPI RIVER.)

STOCKTON AND MORMON SLOUGHS, CAL. (See SAN JOAQUIN RIVER, CAL.)**STONINGTON HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 526.)

Appropriations.

1827-'79	\$184,453.83
1890	25,000.00, '80, 438.
1881	30,000.00, '81, 581.
1882	25,000.00, '82, 598.
1884	10,000.00, '84, 632.
1886	20,000.00, '86, 616.
Total	294,453.83
1888	8,000.00, act of August 11, 1888.

Contracts.

1879. F. K. Ballou, for riprap granite, at 90 cents per ton, '80, 438.
 1880. F. K. Ballou, for riprap granite, at 89 cents per ton, '81, 581.
 1881. F. K. Ballou, for riprap granite, at \$1.14 per ton, '81, 581.
 1882. F. K. Ballou, for riprap granite, at \$1.10 per ton, '83, 500.
 1884. J. A. Bouker, for riprap stone, at \$1.15 per ton, '85, 617.
 1886. J. A. Bouker, for riprap granite in place, at \$1.03 per ton, '87, 564.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 76; '81, 89, 583; '82, 90; '83, 84; '84, 90; '85, 78; '86, 78; '87, 41.

BOARD OF ENGINEERS.

Convened at New York August 24, 1880, to report upon further improvements at Stonington Harbor. Report, '81, 583. (Cols. Tower and Newton.)

ENGINEERS IN CHARGE.

Maj. J. W. Barlow, 1874-'83. Reports, '80, 437; '81, 579; '82, 597.
 Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 500; '84, 616; '85, 616; '86, 614.
 Maj. W. R. Livermore, 1887-'—. Report, '87, 562.

ASSISTANT.

G. C. Almy. Report, '80, 439.

Operations.

- 1879-'80. 34,800 tons granite delivered in breakwater, extending same 483 feet, '80, 437.
 1880-'81. 9,113 tons granite delivered in breakwater, completing the same; 24,750 tons stone delivered in new breakwater, completing 500 feet of same, '81, 579, 580.
 1881-'82. 22,900 tons stone delivered in breakwater, extending the same 570 feet, '82, 598.
 1882-'83. Breakwater extended 451 feet, '83, 501.
 1883-'84. 4,896 tons riprap stone used in breakwater extension, '84, 631.
 1884-'85. 7,500 tons stone delivered in work, extending the same 205 feet, '85, 617.
 1885-'86. No operations for lack of funds, '86, 615.
 1886-'87. 12,835 tons riprap granite delivered in the eastern breakwater, '87, 563.

Projects.

The earliest project, 1827, provided for the construction of a short breakwater at the lower end of the city wharves; this was completed in 1831 at a cost of \$34,766.65, '72, 920; '79, 327; '87, 41.

The project of 1871 proposed dredging a channel 12 feet deep between the breakwater and the steam-boat wharf, at an estimated cost of \$51,368, '72, 919; '73, 980.

By the Board of Engineers, 1875, for a breakwater of granite riprap to extend southeast from the vicinity of Wampasset Point, a distance of about 2,000 feet. Estimated cost, \$231,000, '75, ii, 244, 245, 246. Breakwater completed in 1881, at a cost of \$103,190, '81, 579; '87, 562.

STONINGTON HARBOR, CONN.—Continued.**Projects—Continued.**

By Maj. Barlow, 1880, for an east breakwater between the Middle Ground and Bartlett's Reef, 2,000 feet in length, to be built of stone and granite riprap. Estimated cost, \$100,000, '81, 585. Approved by Board of Engineers, 1880, '81, 585.

Necessity for increasing length of breakwater to 2,600 feet, making the estimated cost \$130,000, '82, 598.

Total amount appropriated from 1827 to 1886, inclusive, \$294,453.83.

Surveys.**MAPS.**

'82, 598; '84, 632.

STONY BROOK HARBOR, N. Y.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 99.

ENGINEER IN CHARGE.

Maj. J. W. Barlow. Report, '84, 664.

Physical Characteristics.

Description of harbor, '84, 664.

Plans.

In 1882 Maj. Barlow, in view of the limited commerce of the locality, did not deem the harbor worthy of improvement, '84, 665.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Barlow, '84, 664.

STURGEON BAY CANAL, WIS.—HARBOR OF REFUGE AT, CONSTRUCTION OF.

(Continued from Vol. I, p. 529.)

Appropriations.

1873-79	\$110,000
1880	10,000, '80, 1909.
1881	10,000, '81, 2076.
1882	20,000, '82, 2136.
1884	10,000, '84, 1847.
1886	5,000, '86, 1661.

Total 165,000

Commerce.

Commercial character of canal, '87, 2034.

Contracts.

1880. Truman & Shroeder, for pier extension, '80, 1909. McDonald & Boalt, for pier extension, '80, 1909; '82, 2138.

1882. Green Bay Dredge and Pile Driver Company, for dredging, at 19 cents per cubic yard, '83, 1656.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 204; '81, 275; '82, 270; '83, 279; '84, 279; '85, 302; '86, 296; '87, 262, 2017.

BOARD OF ENGINEERS.

Convened at Milwaukee, Wis., December 19, 1882, by S. O. No. 51, to report upon cost of constructing Sturgeon Bay and Lake Michigan Ship Canal, and by whom constructed; also upon amount of money realized from sale of lands granted by Congress to aid in construction of the above canal, '83, 1657. (Lieut. Col. Houston and Maj. Robert.)

Constituted by S. O. No. 112, C. of E., 1886, to consider and report upon the expediency and desirability of the acquisition by the Government of the canal. Report, '87, 2021-2037. (Lieut. Cols. Craighill and Gillespie and Capt. Marshall.)

STURGEON BAY CANAL, WIS.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1875-'83. Reports, '80, 1906; '81, 2075; '82, 2134.

Lieut. Col. J. W. Barlow, 1883; '83, 1629.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1655.

Lieut. Col. Barlow, 1884-'86. Reports, '84, 1846; '85, 1988.

Capt. W. L. Marshall, 1846; '86, 290.

Capt. C. E. L. B. Davis, 1836-'—. Reports, '86, 1660; '87, 2014.

ASSISTANT.

L. Y. Schermerhorn. Report, '81, 2136.

Financial Statements.

Receipts and disbursements of the Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company from May 7, 1882, to October 10, 1882, '83, 1666; '87, 2033.

Interest paid from May 7, 1882, to October 10, 1882, '83, 1669.

Cash advances by stockholders in 1872 and 1873, '83, 1673.

General statements of cost, '83, 1666, 1669, 1673; '87, 2030, 2033.

Legislation.

Act of State of Wisconsin accepting Congressional grant of lands for construction of ship-canal, '83, 1658.

Acts of State relating to canal, '87, 2024.

Operations.

1879-'80. 11 cribs built and sunk in extension of north and south piers; crib in north pier replaced; 2 outer cribs covered with plank and entire work filled and rippapped; 210 linear feet brush revetment placed at inner end of pile-piers, '80, 1906, 1907.

1880-'81. 6 cribs built and sunk on detached pier extensions; 3 cribs decked and 25 fender-piles driven; superstructure nearly completed on north pier; 1,392 linear feet sheet-pile revetment built by hired labor; 8,164 cubic yards material dredged in channel, '81, 2075.

1881-'82. 330 linear feet guide-piling built; superstructure built over 16 substructures by hired labor; 190 cords riprap placed around piling; 8,883 cubic yards material dredged, '82, 2134, 2135.

1882-'83. 21,368 cubic yards material dredged from channel between piers; 1 dredge and 2 dump scows built, '83, 1855.

1883-'84. 51,744 cubic yards material dredged from harbor; 200 linear feet sheet-piling, north pier, rippapped; 210 cords stone placed in piers, '84, 1846.

1884-'85. Guide-piling completed; 350 linear feet superstructure built over south pier; stone filling in both piers completed and piers rippapped and planked, '85, 1988.

1885-'86. 30,940 cubic yards material dredged, '86, 1660.

1886-'87. 42,185 cubic yards material dredged from the harbor; extensive repairs made upon piers, '87, 2015.

Summary of work done at the harbor, '87, 2016.

Private and Corporate Work.

Board of Engineers convened to examine and report upon the cost of the canal, '83, 1657; '87, 2021.

Cost of canal as built by canal company, '83, 1661, 1672; '87, 2030.

History of the canal, '87, 2019, 2022.

Projects.

By Maj. Houston, 1871-'74, for two piers to protect entrance to the canal at Lake Michigan, each pier beginning at a point on the shore-line 425 feet from the axis of the canal, extending into the lake and narrowing to 235 feet at the outer ends, each about 1,200 feet long and extending to the 18-foot curve; also the dredging of the outer basin to a depth of 13 feet. Estimated cost, \$180,000, '72, 171, '74, 1, 141.

In 1879-'80 Maj. Robert proposed the construction of 1,392 linear feet of sheet-pile revetment to render the existing pile-piers sand-tight; the widening of the entrance of the harbor to a width of 325 feet by the construction of 150 linear feet detached pier on each side, with fender-piling to connect the ends of the detached piers with ends of the previous pier extension; also the formation of a dredged channel 16 feet deep extending from the harbor entrance to the mouth of the canal, '80, 1907, 1908; '83, 279.

See also BOARD OF ENGINEERS.

Surveys.**MAPS.**

'80, 1908; '81, 2076.

SULPHUR RIVER, TEX.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 227.

ENGINEER IN CHARGE.

Capt. A. M. Miller. Report, '84, 1345.

ASSISTANT.

P. C. Montgomery. Report, '84, 1346.

Plans.

In 1883 Capt. Miller did not consider the river worthy of improvement nor the work a public necessity, '84, 1345.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Capt. Miller, '84, 1345.

SUMPAWANUS INLET, N. Y.—IMPROVEMENT OF.**Appropriations.**

1881..... \$5,000, '81, 653.

1882..... 2,000, '82, 673.

Commerce.

Statistics, '83, 568; '87, 742.

Contracts.

1883. J. McDermott, for dredging, at 69 cents per cubic yard, '83, 569.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 85; '81, 105; '82, 107; '83, 104; '84, 110; '85, 100; '86, 102; '87, 65.

ENGINEERS IN CHARGE.

Col. J. Newton, 1880-'83. Reports, '81, 652; '82, 672.

Lieut. Col. G. L. Gillespie, 1883-'85. Reports, '83, 568; '84, 734; '85, 742.

Lieut. Col. W. McFarland, 1885-'—. Reports, '86, 748; '87, 740.

ASSISTANT.

R. H. Talcott. Report, '81, 654.

Operations.

History of operations, '87, 741.

1882-'83. 9,481 cubic yards material dredged from channel, '83, 568.

1883-'87. No operations, '84, 734; '85, 742; '86, 749; '87, 741.

Projects.

By Col. J. Newton, 1880, for improvement of the inlet by excavation of a 5-foot mean low-water channel from head of tide-water to the bay; width of channel in inlet 100 feet and at the mouth 150 feet. Estimated cost, \$23,115, '81, 655. Increased in 1883 to \$40,000, '83, 568; '87, 741.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Col. Newton, '81, 653.

SUPERIOR BAY AND SAINT LOUIS BAY, WIS.—IMPROVEMENT OF.

(See also DULUTH HARBOR, MINN.)

(Continued from Vol. I, p. 531.)

Appropriations.

1873-'79 \$373,943

1880..... 5,000, '80, 1882.

1881..... 10,000, '81, 2025.

1882..... 40,000, '82, 2105.

1884..... 45,000, '84, 1820.

1886..... 22,500, '86, 1636.

Total 496,483

1888..... 50,000, act of August 11, 1888.

Statement of appropriations, '80, 1881; '81, 2025; '82, 2105; '84, 1819; '85, 1946; '86, 1635; '87, 1948.

Commerce.

Large harborage of bay, '80, 1886.

Decline of commerce up to 1880, '81, 269.

Necessity in 1881 for increased harborage, '81, 2027.

Increase of commerce, '83, 1623; '87, 1950.

SUPERIOR BAY AND SAINT LOUIS BAY, WIS.—Continued.**Commerce—Continued.**

Channels in Superior Bay should be deepened to correspond with increased demands of vessels, '85, 1859, 1964; '86, 1636.

Contracts.

1881. Williams & Upham, for dredging, at 18 cents per cubic yard, '82, 2105.

1882. Williams & Upham, for dredging, at 17 cents per cubic yard, '83, 1621.

1884. Williams & Upham, for dredging, at 24 cents per cubic yard, '84, 1818. Williams & Upham, for dredging, at 15 cents per cubic yard, '85, 1947.

1886. C. S. Barker, for dredging, at 18 cents per cubic yard, '87, 1949.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 201; '81, 269; '82, 264; '83, 273; '84, 272; '85, 294, 296; '86, 288; '87, 254.

BOARD OF ENGINEERS.

Convened by S. O. No. 3, C. of E., 1881. Maj. Houston and Capt. Mackenzie and Allen, '80, 2024, 2029. (See PROJECTS.)

ENGINEERS IN CHARGE.

Maj. F. U. Farquhar, 1879. Report, '79, 1468.

Maj. C. J. Allen, 1879-'86. Reports, '80, 1880; '81, 2024; '82, 2103; '83, 1618; '84, 1818; '85, 1944, 1959; '86, 1632.

Capt. J. B. Quinn, 1886-'— Report, '87, 1945.

ASSISTANTS.

J. P. Frizell. Report, '80, 1889.

G. Wells. Report, '83, 1621.

J. B. Parkinson. Report, '85, 1963.

Operations.

History of previous operations, '79, 1470; '86, 288, 1632.

No operations between 1874 and 1879, except a small amount of dredging in 1879 at Rice's and Connor's Points, '80, 201.

1879-'80. Repairs to piers at entry and the preservation of Minnesota and Wisconsin Points, by hired labor, '80, 1880.

1880-'81. Repairs, by hired labor, to piers and shore protection at Minnesota Point, '81, 2024.

1881-'82. Repairs to piers at entry and dredging 53,466 cubic yards from the entry and Nemadji River and Quebec Wharf channels, '82, 2103.

1882-'83. Protection of Minnesota Point Beach, by hired labor, 103,629 cubic yards dredged from channels at the entry, Quebec Wharf, and Northern Pacific Railroad Dock, '83, 1619.

1883-'84. Repairs, by hired labor, to Minnesota Point shore protection; 90,674 cubic yards dredged from channels at entry, Quebec Wharf, and Northern Pacific Railroad Dock, '84, 1818.

1884-'85. Extensive repairs, by hired labor, to 867 linear feet of the south pier, with slight repairs to north pier and sand fence at the opening; 152,738 cubic yards dredged from channels at the entry, Quebec Wharf, and Northern Pacific Railroad Dock, '85, 1944.

1885-'86. Repairs to piers at entry, by hired labor; 34,485 cubic yards dredged from channels at entry, in Saint Louis River, and at Quebec and Northern Pacific Railroad Docks '86, 1634. Ruling depths of channels dredged, '86, 1634.

1886-'87. Deepening channel along Wisconsin Dock line, Saint Louis Bay, '87, 1947.

Physical Characteristics.

Changes at head of bay, '80, 1885, 1889.

Movement of drift, '80, 1886.

Time of opening and closing bay in winter, '80, 1889.

Oscillation of lake surface, '80, 1891.

Description of Saint Louis bay and River, '85, 1963.

Plans.

By Maj. Allen, 1885, for improvement of Saint Louis Bay by the formation of a dredged channel 250 feet wide and 16 feet deep on the Wisconsin side past Connor's Point to 1,000 feet along the railroad bridge. Estimated cost, \$70,950 '85, 1959, 1963; '87, 1947.

Projects.

By Board of Engineers, 1881, for enlargement of harbor area and channel facilities by deepening to 16 feet the channel in entry between the piers, and from thence parallel to shore of Superior Bay, past the mouth of Nemadji River, to Quebec Wharf, thence along west side of bay to an intersection with the channel of the Saint Louis River opposite Connor's Point; also, the deepening of Nemadji River for about half a mile, estimated cost of dredging, \$287,080; the preservation of existing piers by repairs at an estimated cost of \$25,000. Estimated cost of entire project, \$312,080, '81, 270, 2024, 2028; '82, 2103. (Maj. Houston, Capt. Mackenzie and Allen.)

SUPERIOR BAY AND SAINT LOUIS BAY, WIS.—Continued.**Projects—Continued.**

In 1884 Congress provided for deepening to 16 feet the channel of the Saint Louis River within Superior Bay, thereby adding \$33,000 to the original estimate for existing project, '85, 294, 1962; '86, 1633; '87, 1948.

Surveys.

1880, under direction of Capt. Allen, to determine the best plan for harbor improvement for the head of Lake Superior, '80, 1884, 1889.

Survey of Saint Louis Bay and River from Connor's and Rice's Points to foot of first falls, ordered by act of July 5, 1884. Made under direction of Maj. Allen, '85, 1959.

MAPS.

'85, 1944; '87, 1944.

SUPERIOR CITY HARBOR, WIS. (See SUPERIOR BAY, WIS.)**SUSQUEHANNA RIVER, PA., NORTH BRANCH OF—IMPROVEMENT OF.**

(Continued from Vol. I, p. 536.)

Appropriations.

1880..... \$15,000, '80, 594.
1881..... 15,000, '81, 804.
1882..... 15,000, '82, 781.

Commerce.

Statistics, '83, 654.

Contracts.

1881. Coon & Mooney, for dredging, at 70 cents per cubic yard, '81, 806. J. Van Paten, for dike construction, at \$4.72 per running foot, '81, 806. R. C. Mitchell, for dredging, at 90 cents per cubic yard, '82, 781.

1883. R. C. Mitchell, for dredging, at 75 cents per cubic yard; for rock backing, at \$2 per cubic yard, and for dike construction, at \$8 per linear foot, '83, 652.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 96, 97; '81, 127; '82, 124; '83, 128; '84, 136, 139; '85, 125, 127.

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1879-'82. Report, '80, 594; '81, 804.

Capt. W. Ludlow, 1882-'83. Report, '82, 779.

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 652.

Maj. W. H. Heuer, 1884-'85. Report, '84, 842, 869.

Lieut. Col. H. M. Robert, 1885. Report, '85, 854, 864.

ASSISTANTS.

J. Worrall. Report, '80, 594.

H. Alrichs. Report, '80, 599.

G. H. Dager. Reports, '81, 806; '83, 653; '84, 869.

A. Stierle. Report, '84, 842.

Operations.

1880-'81. 2,548 cubic yards material dredged from Richards and Wilkes Barre Island shoals, and 625 linear feet of dike built, '81, 807.

1881-'82. 8,042 cubic yards material dredged from Hillman's Ripple and Forty Foot Shoal, '82, 780.

1882-'83. 5,433 cubic yards material dredged from Forty Foot Shoal and 927 cubic yards rock blasted from Hillman's Ripple, '83, 653.

1883-'84. 3,677 cubic yards material dredged from shoals at Richards and Wilkes Barre islands, '84, 842.

1884-'85. No operations, '85, 854.

Physical characteristics.

Description of river and its obstructions between Athens and Wilkes Barre, '80, 600.

Projects.

By Col. Macomb, 1881, for improvement of the river between Wilkes Barre and Pittston by excavation of channels through shoals at various points, having an average depth of 3 feet, also for construction of submerged dikes or deflectors at points of excavation. Estimated cost, \$48,537, '81, 805.

No general projects ever adopted, '85, 125.

SUSQUEHANNA RIVER, PA., NORTH BRANCH OF—Continued.**Surveys.**

Examination ordered by act of March 3, 1879. Made, 1880, under direction of Col. Macomb, '80, 594.

Ordered by act of August 2, 1882. Made, 1883, under direction of Lieut. Col. Weitzel, '84, 869.

Of West Branch ordered by act of July 5, 1884. Made, 1884, under direction of Maj. Heuer, '85, 864, and adjudged by him as not a public necessity, '84, 869.

SUSQUEHANNA RIVER, above and below Havre de Grace—IMPROVEMENT OF.

(Continued from Vol. I, p. 534.)

Appropriations.

1862-'79	\$54,890
1880	28,000, '80, 621.
1881	15,000, '81, 851.
1882	25,000, '82, 836.
1884	20,000, '84, 839.
1886	6,000, '86, 865.

Total..... 148,890

1888..... 10,000, act of August 11, 1888.

Contracts.

1881. Morris & Cumings Dredging Company, for dredging, at 14½ cents per cubic yard, '81, 852.

1883. American Dredging Company, for dredging, at 19½ cents per cubic yard, '83, 865.

1885. Baltimore Dredging Company, for dredging, at 18 cents per cubic yard, '86, 865.

1886. Baltimore Dredging Company, for dredging, at 22 cents per cubic yard, '87, 837.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 98; '81, 129; '82, 127; '83, 131; '84, 139; '85, 131; '86, 129; '87, 92.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1870-'85. Reports, '80, 615; '81, 849; '82, 836, 837; '83, 664; '84, 888.

W. F. Smith, U. S. Agent, 1885-'—. Reports, '85, 882; '86, 864; '87, 836.

Operations.

History of early operations, '80, 617.

1880-'81. 81,576 cubic yards material dredged from channel between Havre de Grace and Spesutie Island; 16 boom crib-piers removed by dynamite, '81, 850.

1881-'82. Moving crib near gateway extended 200 feet, and crib line built in prolongation of northwest face of main basin, '82, 836.

1882-'83. No operations, '83, 664.

1883-'84. 73,000 cubic yards material dredged from channel above and below the bridge, '84, 888.

1884-'85. Basin formed by 580 linear feet of pile and sheet piling construction, '85, 882.

1885-'86. 63,433 cubic yards material dredged from channel through shoals below railroad bridge and at Watson's Island, '86, 865.

1886-'87. Dredging continued between Havre de Grace and Watson's Island, '87, 837.

Plans.

By Lieut. Col. Craighill, 1882, for the permanent improvement of the river below Havre de Grace, to a depth of 15 feet at mean low water by deflectors and dredging; also deepening by dredging to a depth of 8 feet the channel through the bar above the bridge. Estimated cost, \$168,000, '82, 838.

For plans of Fish Basin, see, '84, 888.

Projects.

The original project of 1853 proposed the formation of a dredged channel 100 feet wide and 10 feet deep at mean low water between Havre de Grace and the mouth of the river. Estimated cost, \$37,000, '80, 616.

In 1866, it having been found that the above-described dredged channel had largely refilled, Maj. Craighill proposed the use of a temporary floating deflector to train the current towards the line of the main channel, '67, 42, 419, 427; '80, 617.

SUSQUEHANNA RIVER—Continued.**Projects—Continued.**

In 1871 the floating deflector was replaced by a pile-dike, '71, 590, 591; '80, 618.
 In 1880 Maj. Craighill proposed the application of the \$28,000 appropriated in 1860 to the formation of channel having a mean low-water depth of 12 feet between Havre de Grace and Spesutie Island, also dredging at Battery Light, and removal of cribs above Havre de Grace, '80, 621.
 Since 1882 the dredged channel has been maintained by systematic dredging to a depth of about 12 feet below Havre de Grace and 8 feet through the shoal near Watson's Island. An ultimate depth of 15 feet is proposed below the bridge, '87, 92.

Surveys.**MAPS.**

'84, 888.

Above Havre de Grace, '87, 836.

SUWANNEE RIVER, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 536.)

Appropriations.

1839.....	\$15,000.
1880.....	5,000, '80, 1078.
1881.....	3,000, '81, 1193.
1882.....	5,000, '82, 1270.
1883.....	5,000, '84, 1180.
1886.....	5,000, '86, 1144.

Total 38,000

1888..... 15,000, act of August 11, 1888.

Contracts.

1881. J. E. Slaughter, for dredging, at 50 cents per cubic yard, '81, 1194.

1882. S. N. Kimball, for dredging, at 50 cents per cubic yard, '83, 987.

1884. S. N. Kimball, for dredging, at 47 cents per cubic yard, '85, 1266.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 136; '81, 184; '82, 180; '83, 190; '84, 198; '85, 195; '86, 194; '87, 161.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1879-'85. Reports, '80, 1078; '81, 1193; '82, 1269; '83, 986; '84, 1179.

Capt. W. T. Rossell, 1885-'86. Report, '85, 1265.

Capt. W. M. Black, 1886-'—. Reports, '86, 1143; '87, 1253.

Operations.

1881-'82. 17,026 cubic yards material dredged, '82, 1269.

1882-'83. No operations, '83, 987.

1883-'84. 8,205 cubic yards material dredged, '84, 1179.

1884-'85. 4,418 cubic yards material dredged, '85, 1266.

1885-'86. 4,582 cubic yards material dredged, '86, 1143.

1886-'87. 56 snags and logs, 370 cubic yards of rock removed from the channel, and 77 trees cut, '87, 1254, 1255.

Projects.

By Maj. Damrell, 1879, for improvement of the Suwannee River from its mouth to Roland's Bluff, a distance of 74 miles, by the formation of a 5-foot channel 150 feet wide; thence to Ellaville, a distance of 50 miles, a channel 4 feet deep and 60 feet wide, to be accomplished by snag and rock removal, dam construction, and dredging. Estimated cost, \$55,158, '79, 857, 862, 863; '86, 1143.

Surveys.

Ordered by act of June 18, 1878, '78, 81. Made under direction of Capt. Damrell, 1878, '79, 857.

SWAN CREEK, LAKE SAINT CLAIR, MICH.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 221; '81, 301.

SWAN CREEK, LAKE SAINT CLAIR, MICH.—Continued.**Engineers—Continued.**

ENGINEER IN CHARGE.

Maj. F. Harwood. Report, '81, 2255.

Plans.

By Maj. Harwood, 1881, for improvement of Swan Creek from the Fair Haven Bridge to its present outlet into Lake Saint Clair, by excavation of a 9-foot channel from the bridge to 9-foot curve in Lake Saint Clair. Estimated cost, \$10,000; or, for a channel of same depth to the Elbow, and thence a canal 50 feet wide with 9 feet depth to 10-foot curve in the Lake. Estimated cost, \$17,000; '81, 2257.

Surveys.

Examination ordered by act of June 14, 1880. Made, 1881, under direction of Maj. Harwood, '81, 2255.

SWANTON HARBOR, VT.—IMPROVEMENT OF.

(Continued from Vol. I, p. 536.)

Appropriations.

1873-'79	\$61,000
1880	2,500, '80, 559.
1881	2,500, '81, 725.
1882	4,500, '82, 710.

Total. 70,500

Contracts.

1882. N. W. Fisk, for rubble-stone, at 83 cents per cubic yard, '82, 711.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 89; '81, 114; '82, 115; '83, 324; '84, 328; '85, 355, 357; '86, 348; '87, 314.

ENGINEERS IN CHARGE.

Lieut. Col. N. Michler, 1880-'81. Reports, '80, 558; '81, 724.

Col. J. Newton, 1881; '82, 683.

Lieut. Col. G. L. Gillespie, 1881-'83. Report, '82, 710.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1958; '84, 2156; '85, 2321, 2324.

Maj. M. B. Adams, 1885-'— . Reports, '85, 2305; '86, 1901; '87, 2399.

ASSISTANT.

L. Y. Schermerhorn. Report, '85, 2325.

Operations.

1879-'80. Repairs of breakwater, '80, 558.

1880-'81. Widening foundation of breakwater, '81, 724.

1881-'82. One 73-foot crib sunk in repair of breach in breakwater and 687 cubic yards filling placed in same, '82, 710.

1882-'83. Stone filling of crib sunk in 1881 completed and an additional crib commenced, '83, 1958.

1883-'84. 50 linear feet of crib substructure and 78 linear feet of superstructure built, '84, 2156.

1884-'87. No operations, '85, 2305; '86, 1901; '87, 2399.

Plans.

By Lieut. Col. Robert, 1885, for the construction of a breakwater directly in front of existing and proposed wharves. Estimated cost, \$140,000, '85, 2324.

Projects.

By Lieut. Col. Newton, 1873, for the construction of a breakwater of crib-work filled with stone, for the protection of the docks and wharves at Swanton. Estimated cost, \$272,600, '73, 397, 398; '74, i, 275. Reduced to \$240,000, '79, 397; '82, 710.

Surveys.

Ordered by act of July 5, 1884. Made under direction of Lieut. Col. Robert, '85, 2324.

MAPS.

Of Maquam Bay, '85, 2324.

SYNEPUXENT BAY, MD. (See INDIAN RIVER, MD.)**TAGGART'S VALLEY RIVER, W. VA.—SURVEY OF.**

(See also BUCKHANNON RIVER, W. VA.)

Engineers.

CHIEF OF ENGINEERS.

Report, '84, 263.

ENGINEER IN CHARGE.

Maj. W. E. Merrill, 1883. Report, '84, 1718.

ASSISTANT.

J. B. Holbrook, '84, 1719.

Physical Characteristics.

Description of, '84, 1718.

Plans.

Maj. Merrill reports the river as worthy of improvement although not a public necessity, '84, 1719.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Merrill, '84, 1718.

TALLAHATCHEE RIVER, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 537.)

Appropriations.

1879.....	\$6,000
1880.....	9,000, '80, 1319.
1881.....	3,000, '81, 1412.
1882.....	3,000, '82, 1551.
1884.....	3,000, '84, 1336.
1886.....	3,500, '86, 1362.

Total..... 27,500

1888..... 5,000, act of August 11, 1888.

Statement of appropriations, '87, 1475.

Commerce.

Commerce of the river, '83, 1148.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 155; '81, 209; '82, 206; '83, 215; '84, 224; '85, 239; '86, 234; '87, 200.

ENGINEERS IN CHARGE.

Maj. W. H. H. Bonyard, 1879-'83. Reports, '80, 1319; '81, 1411; '82, 1550.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1148; '84, 1335.

Capt. E. Bergland, 1885-'87. Reports, '85, 1517; '86, 1361.

Capt. J. H. Willard, 1887-'— Report, '87, 1474.

ASSISTANT.

J. J. Barry. Report, '80, 1320.

Operations.

1879-'80. 25,381 trees cut down and girdled, '80, 1319.

1880-'81. 27 snags and logs removed and 31,538 trees cut and deadened, '81, 1412.

1881-'82. 457 snags and logs removed from the channel, '82, 1551.

1882-'83. 405 snags pulled, 6,740 yards brush cut, and 2,167 trees and logs cut, deadened, and removed from river-bed, '83, 1148.

1883-'84. No operations, '84, 1335.

1884-'85. 857 snags and stumps pulled, 2 side-jams removed, and 557 trees cut and girdled, '85, 1517.

1885-'86. No operations, '86, 1362.

1886-'87. 1,107 logs, snags, and trees removed, and 2,727 leaning trees cut, '87, 1475.

TALLAHATCHEE RIVER, MISS.—Continued.**Projects.**

By Maj. Benyaud, 1879, for improvement of the low-water navigation of the river from its junction with the Cold Water River to the mouth, a distance of 165 miles, by removal of snags, trees, and the wreck of a steamer. Estimated cost, \$40,000, '79, 116, 971, 985; '87, 200, 1774.

TALLAPOOSA RIVER, ALA.—IMPROVEMENT OF.**Appropriations.**

1882.....	\$15,000, '83, 999.
1884.....	10,000, '84, 1191.
1886.....	7,500, '86, 1173.
1888.....	7,500, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '83, 192; '84, 200; '85, 203; '86, 201; '87, 169.

ENGINEERS IN CHARGE.

Maj. A. N. Damrell, 1880-'85. Reports, '81, 1223; '83, 998; '84, 1189.

Capt. R. L. Hoxie, 1885-'—. Reports, '85, 1307; '86, 1172; '87, 1285.

ASSISTANT.

G. B. Yuille. Report, '80, 1224.

Operations.

1883-'84. 2,086 logs and snags and 34 overhanging trees removed, '84, 1190.

1884-'85. New snag-boat with steam capstan, etc., built and a limited amount of work done, '85, 1307.

1885-'86. 2,423 snags, logs, and trees removed, clearing 12 miles of river, '86, 1172.

1886-'87. 4,053 logs, snags, and trees, and 33 cubic yards rock removed from river channel; 320 linear feet of temporary dam work built, '87, 1286.

Physical Characteristics.

Description of the river, '81, 1224.

Projects.

By Maj. Damrell, 1881, for improvement of the Tallapoosa River from the foot of Tallassee Reefs to its mouth, a distance of 48 miles, giving a 3-foot channel with 60-foot width in soft rock cuts and 200 feet in open river, by removal of snags, logs, and similar obstructions, bank protection, dike and wing dam construction, and gravel and soft rock excavation. Estimated cost, \$40,125, '81, 1230, '87, 1285.

Surveys.

Ordered by act of June 14, 1880. Made, 1831, under direction of Maj. Damrell, '81, 1223.

TAMPA BAY, FLA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 537.)

Appropriations.

1880.....	\$10,000, '80, 1078.
1881.....	10,000, '81, 1192.
1882.....	20,000, '82, 1268.
1884.....	20,000, '84, 1178.
1886.....	10,000, '86, 1139.

Total.....	70,000
1888.....	25,000, act of August 11, 1888.

Contracts.

1881. J. E. Slaughter, for dredging, at 50 cents per cubic yard, '81, 1191.

1885. J. E. Slaughter, for dredging, at 34 $\frac{7}{10}$ cents, and rock excavation, at \$5.90 per cubic yard, '85, 1264.

1887. J. R. Moore, for rock excavation, at \$5.90 per cubic yard, and dredging, at 44 cents per cubic yard, '87, 1244.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 136; '81, 183; '82, 179; '83, 189; '84, 198; '85, 194; '86, 192; '87, 159, 162.

TAMPA BAY, FLA.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. A. N. Damrell, 1878-'85. Reports, '80, 1077; '81, 1191; '82, 1268; '83, 963; '84, 1178.

Capt. W. T. Russell, 1885-'86. Report, '85, 1262.

Lieut. W. M. Black, 1886-'—. Reports, '86, 1137; '87, 1243, 1257.

ASSISTANT.

J. W. Sackett. Report, '87, 1246.

Operations.

1880-'81. 18,530 cubic yards material dredged from the channel, '81, 1191.

1881-'82. 30,709 cubic yards material dredged from the channel, '81, 1191; '82, 1268.

1882-'83. 16,691 cubic yards material dredged and 2,470 cubic yards of rock blasted from the channel, '83, 983.

1883-'84. No operations for lack of funds, '84, 1178.

1884-'85. 3,632 cubic yards mud and 914 cubic yards gravel removed, '85, 1263.

1885-'86. 24,093 cubic yards mud and 1,200 cubic yards stone removed from channel, '86, 1138.

1886-'87. Rock removal and dredging continued, '87, 1245.

Projects.

By Lieut. Col. Damrell, 1879, for improvement of Tampa Bay by deepening the present channel from Ballast Point to Tampa, a distance of 5½ miles, by dredging and rock removal to 9 feet, with 200 feet width in the river and 150 feet in the bay. Estimated cost, \$97,000, '79, 871; '80, 1077. Increased in 1886 and 1887 to \$133,000, '86, 1189; '87, 1245.

In 1887 Capt. Black considered that the demands did not require an improvement beyond that called for under existing project, '87, 1258.

Surveys.

Examination and resurvey of Tampa Bay, including Hillsborough River, up to city of Tampa, ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Black, '87, 1257.

MAPS.

'86, 1138; '87, 1247.

TANGIER SOUND, IND. (See DEAL'S ISLAND, UPPER AND LOWER THOROUGHFARE INTO.)**TANGIPAHOA RIVER, LA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 538.)

Appropriations.

1872.....	\$2,500
1880.....	5,000, '80, 1156.
1881.....	2,000, '81, 1283.
1884.....	2,000, '84, 1268.

Total 11,500

Contracts.

1880. C. P. Seymer, for removal of obstructions, '81, 1282.

1883. C. E. Cate, for removal of obstructions, at \$235 per mile, '83, 1108.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 142; '81, 193; '82, 189; '83, 207; '84, 210; '85, 215; '86, 213; '87, 180.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1871-'82. Reports, '80, 1156; '81, 1282.

Maj. A. Stickney, 1882-'85. Reports, '82, 1374; '83, 1107; '84, 1266.

Maj. W. H. Heuer, 1885-'—. Reports, '85, 1393; '86, 1241; '87, 1361.

ASSISTANT.

H. C. Collins. Report, '84, 1266.

Operations.

1880-'81. 6½ miles of river cleared of obstructions, '81, 1283.

1881-'82. Improvement of river under Seymer's contract completed, 34 miles, '82, 1374.

TANGIPAHOA RIVER, FLA.—Continued.**Operations—Continued.**

- 1832-'83. Work under Cate's contract commenced, '83, 1108.
 1833-'84. Obstructions removed throughout 7½ miles of river, '84, 1266.
 1884-'85. Work of cleaning the river continued under hired labor, '85, 1393.
 1885-'87. No operations, '86, 1242; '87, 1362.

Projects.

The appropriation of \$2,500 of 1872 was applied to the removal of snags and other obstructions, '73, 64, 631.

By Maj. Howell, 1879, for improvement of the Tangipahoa River from its junction with the Amite to its mouth, a distance of 53 miles, by removal of snags, logs, trees, and similar obstructions. Estimated cost, \$10,700, '79, 946, 949; '86, 1241.

TAR RIVER, N. C. (See PAMLICO RIVER, N. C.)**TAUNTON RIVER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 539.)

Appropriations.

1870-'79	\$63,000
1880	17,500, '80, 377.
1881	25,000, '81, 556.
1882	25,000, '82, 555.
1884	26,500, '84, 607.

Total 157,000

Contracts.

1880. G. W. Townsend, for removal of bowlders, '80, 372. W. Flannery, for dredging, at 47 cents per cubic yard, '81, 555.
 1881. W. H. Beard, for dredging, at 49½ cents per cubic yard, '81, 555.
 1882. W. H. Beard, for dredging, at 97 cents per cubic yard, '83, 478. J. H. Fenner, for dredging, at 35 cents per cubic yard, '83, 478.
 1883. C. H. Edwards, for rock removal, '84, 606.
 1884. J. H. Fenner, for dredging, '85, 590.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 73; '81, 80; '82, 80; '83, 77; '84, 83; '85, 71; '86, 72; '87, 35, 43.

ENGINEERS IN CHARGE.

Lient. Col. G. K. Warren, 1872-'82. Reports, '80, 371; '81, 554.

Maj. J. W. Barlow, 1882. Report, '82, 554.

Lient. Col. G. H. Elliot, 1882-'87. Reports, '83, 477; '84, 604; '85, 588; '86, 595.

Maj. W. R. Livermore, 1887-'— . Report, '87, 544.

ASSISTANT.

J. P. Cotton. Report, '80, 373.

Operations.

1879-'80. 190 cubic yards rock and bowlders removed from the upper river, '80, 372.

1880-'81. 12,190 cubic yards material dredged from the channel, '81, 555.

1881-'82. 12,268 cubic yards material dredged, '82, 554.

1882-'83. 5,672 cubic yards material dredged, '83, 478.

1883-'84. 27,170 cubic yards material dredged; 715 cubic yards rock removed, '84, 605, 606.

1884-'85. 4,811 cubic yards material dredged; 100 cubic yards bowlders and rock removed, '85, 590.

1885-'86. Dredging and rock removal continued, '86, 596.

1886-'87. Dredging and rock removal combined, '87, 545.

Projects.

The project of 1871 proposed the formation of a channel by dredging 9 feet deep at high water through the shoals between Dighton and Weir village. Estimated cost, \$54,400, '71, 94,891.

From 1870 to 1879, inclusive, \$63,000 was appropriated. In 1880 the project was modified so as to secure a navigable depth at high water of 11 feet and a width of 60 feet from Weir Bridge to Ship Yard, 80 feet wide and 11 feet deep to the Needles, thence to Berkley Bridge, same width and 12 feet depth, and from Berkley Bridge to Dighton, 100 feet wide and 12 feet deep. Estimated cost, \$94,000, '80, 376; '86, 595. Amount appropriated from 1880 to 1886, inclusive, \$94,000.

TAUNTON RIVER, MASS.—Continued.**Surveys.**

Examination ordered by act of August 5, 1886, '87, 43.

MAPS.

'84, 606.

TCHEFUNCTE RIVER, LA.—IMPROVEMENT OF.

(See also BOGUE FALIA, LA.)

(Continued from Vol. I, p. 540.)

Appropriations.

1872.....	\$6,000
1881.....	1,500, '81, 1284.
1882.....	1,500, '82, 1376.
1886.....	*2,500, '86, 454.

Total..... 11,500

Contracts.

1881. W. Fagan, for removal of obstructions, at \$100 per mile, '82, 1375.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 145; '81, 193; '82, 189; '83, 208; '84, 211; '85, 216; '86, 214; '87, 179, 184.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1880-'82. Reports, '80, 1181; '81, 1283; '87, 1358.

Maj. A. Stickney, 1882-'85. Reports, '82, 1375; '83, 1109; '84, 1368.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1394; '86, 1242; '87, 1358.

ASSISTANTS.

W. H. Hoffman. Report, '80, 1181.

H. C. Collins. Report, '84, 1269.

Lieut. O. T. Crosby. Reports, '85, 1395; '86, 1243; '87, 1359.

Operations.

1881-'82. Four miles of river cleaned of obstructions, '82, 1376.

1882-'86. No operations, '83, 1109; '84, 1268; '85, 1395; '86, 1243.

1886-'87. Channels through Bogue Falia, between Old Landing and Crompton, deepened, '87, 180.

Projects.

The appropriation of \$6,000 in 1872 was applied to the removal of the wreck of the gun-boat Oregon, '73, 65, 634.

By Maj. Howell, 1880, for improvement of the Tchefuncte River by removal of snags and similar obstructions from the mouth to Covington and dredging on bar at entrance to Lake Pontchartrain. Estimated cost, \$5,460, '80, 1182.

By Maj. Stickney, 1884, for formation of a channel across the bar 100 feet wide and 7 feet deep, by dredging and the construction of 2,500 linear feet of break-water. Estimated cost, \$20,400, '84, 1270.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Howell, '80, 1181.

Of Bogue Falia from present landings to Covington, La., ordered by act of August 5, 1886, '87, 188.

TCHULA LAKE, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 541.)

Appropriations.

1881.....	\$3,000, '81, 1414.
1882.....	2,500, '82, 1552.

* Improving Tchefuncte River and Bogue Falia.

TCHULA LAKE, MISS.—Continued.**Appropriations—Continued.**

1884..... \$1,500, '84, 1335.
 1886..... 2,000, '86, 1361.

Total 9,000

1888..... 3,000, act of August 11, 1888.

Statement of appropriations, '87, 1472.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 210; '82, 207; '83, 215; '84, 224; '85, 238; '86, 234;
 '87, 199.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1879-'82. Reports, '80, 1350; '81, 1414; '82, 1552.

Maj. A. M. Miller, 1882-'84. Report, '83, 1150, '84, 1335.

Capt. E. Bergland, 1834-'87. Reports, '85, 1514; '86, 1360.

Capt. J. H. Willard, 1887-'— . Report, '87, 1471.

ASSISTANTS.

H. C. Wilson. Report, '82, 1553.

W. S. Davis. Reports, '83, 1151; '85, 1515.

Operations.

1881-'82. 12,551 trees cut down and deadened and 686 snags removed, '82, 1552.

1882-'83. 19,785 trees cut, girdled, and topped; 3,348 snags and logs cut, '83, 1150.

1883-'84. No operations, '84, 1335.

1884-'85. 946 trees cut, topped, and girdled, and 111 snags removed, '85, 1515.

1885-'86. No operations for lack of funds, '86, 1360.

1886-'87. 4,180 trees, snags, and stumps, and 1 wreck removed, '87, 1472.

Projects.

By Maj. Benyaurd, 1879, for improvement of Tchula Lake from Honey Island to its junction with the Yazoo, a distance of 80 miles, by removal of logs, snags, and similar obstructions. Estimated cost, \$10,000, '80, 1351.

The improvement not considered permanent, '86, 234.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Benyaurd, '80, 1350.

TENNESSEE RIVER, ABOVE AND BELOW CHATTANOOGA, TENN.—IMPROVEMENT OF.

(Continued from Vol. I, p. 541, 542.)

Appropriations.

1827-'79, below Chattanooga..... \$1,548,051.94
 1880..... 300,000, '80, 1674.
 1881..... 250,000, '81, 1848.
 1882..... 250,000, '82, 1842.
 1884..... 350,000, '84, 1643.
 1886..... 262,500, '86, 1513.

Total 2,960,551.94

1888..... 250,000, act of August 11, 1888.

1852-'79, above Chattanooga..... 241,500

1880..... 10,000, '80, 1671.

1881..... 7,000, '81, 1841.

1882..... 7,000, '82, 1839.

1884..... 3,000, '84, 1641.

1886..... 7,500, '86, 1510.

Total 276,000

1888..... 15,000, act of August 11, 1888.

Total above and below Chattanooga.. 3,234,645

Commerce.**ABOVE CHATTANOOGA:**

Justification of improvement, '81, 1819; '82, 1838; '84, 1640.

TENNESSEE RIVER, TENN.—Continued.**Commerce—Continued.****BELOW CHATTANOOGA:**

Justification of improvement, '81, 1446; '82, 1812; '86, 1514.

Obstruction arising from railroad bridge at Johnsonville, '81, 1846.

Contracts.

S. N. Kimball (1879), annulled, '80, 184, 1672.

1887. M. A. Sweeney & Brothers, for construction of snag and tow boat, '87, 1745.

A. R. Perry, for construction of hull for dredge-boat, '87, 1745.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 183; '81, 247; '82, 242; '83, 250; '84, 250; '85, 273; '86, 264; '87, 230.

ENGINEERS IN CHARGE.

Maj. W. R. King, 1876-'86. Reports, '80, 1669; '81, 1839; '82, 1837; '83, 1477; '84, 1639; '85, 1751.

Lieut. Col. J. W. Barlow, 1886-'—. Reports, '86, 1509; '87, 1737, 1739.

ASSISTANTS.

J. L. Cary. Reports, '81, 1840; '82, 1838; '83, 1478.

J. E. Willard. Reports, '81, 1845; '82, 1840; '83, 1481.

C. A. Locke. Report, '82, 1841.

H. J. Gielow. Reports, '82, 1841; '83, 1482.

R. Hooke. Reports, '82, 1841; '83, 1482; '85, 1755; '86, 1511.

W. A. Toms. Reports, '83, 1481; '84, 1643; '85, 1755; '86, 1512.

Lieut. H. E. Waterman. Report, '87, 1743.

Operations.**ABOVE CHATTANOOGA:**

All operations by hired labor, '80, 1670.

1879-'80. Rock excavation and construction of wing-dams on Chota and Coulter's shoals, '80, 1669. Completion of dams, '81, 1840.

1880-'81. Construction of wing-dams at Little River Shoals and repairing of dams at Half Moon Island, '81, 1840.

1881-'82. Construction of wing-dams at Little River Shoals, '82, 1838.

1882-'83. Construction of wing-dams at Little River and William Island shoals, '83, 1478.

1884-'84. No operations for lack of funds, '84, 1640.

1884-'85. Rock removal and construction of wing-dams at Chota, William Island, Lyons, Knoxville, and Baker's shoals, '85, 1752.

1885-'86. No operations for lack of funds, '86, 1510.

1886-'87. 466 cubic yards stone quarried and 390 cubic yards of same placed in dams at upper Half Moon Island; flat scows built and snag-boat in progress, '87, 1738.

BELOW CHATTANOOGA:

1879-'80. Excavation of rock and construction of wing-dams by hired labor, on Elk River division, '80, 1671. Canal construction at Muscle Shoals, '80, 1672. Channel improvement and canal construction on Little Muscle Shoals division, '80, 1673.

1880-'81. Channel improvement and lock construction on Elk River division, '81, 1842. Canal construction at Muscle Shoals, '81, 1843. Channel improvement on Little Muscle Shoals division, '81, 1845.

1881-'82. Channel improvement and lock construction on Elk River division, '82, 1840. Canal construction at Muscle Shoals, '82, 1841. Removal of snags from river below Florence, '82, 1841.

1882-'83. Channel improvement and canal construction on Elk River division, '83, 1481. Canal construction at Muscle Shoals, '83, 1482. Removal of snags from river below Florence, '83, 1482.

1883-'84. Canal construction on Elk River division, '84, 1642.

1884-'85. Canal construction on Elk River and Muscle Shoals divisions, '85, 1755.

1885-'86. Canal construction on Elk River and Muscle Shoals divisions, '86, 1511.

1886-'87. Iron gates of Locks 4 to 9, inclusive, placed in position, Shoal Creek Aqueduct built, and permanent dams of rubble masonry built at Second, Bluewater, Four-Mile creeks, and at Helltown, '87, 1740, 1743.

Physical Characteristics.

Stages of river from 1874 to 1880, '80, 1670.

Plans.

By Lieut. Col. Barlow, 1887, for improvement of Colbert and Bee Tree Shoals by locks and dams. Estimated cost, \$973,175, '87, 1748, 1751.

Private and Corporate Work.

Old canal at Bluewater and Shoal Creek, built by State of Alabama, '80, 1673.

Obstruction arising from railroad bridge at Johnsonville, '81, 1846.

TENNESSEE RIVER, TENN.—Continued.**Projects.****ABOVE CHATTANOOGA:**

By Maj. McFarland, 1871, for an improved channel to a depth of 3 feet at low water between Chattanooga and Knoxville, a distance of 189 miles, and requiring the removal of 29 obstructing reefs and shoals. Estimated cost, \$175,000, '71, 502, 507; '77, 579. Increased in 1877 to \$225,000, '79, 1248; '80, 1669; '81, 1841; '87, 1738.

BELOW CHATTANOOGA:

The projects of 1872-'77 proposed the improvement of about 456 miles of river by the construction of a canal $1\frac{1}{4}$ miles long, 70 to 120 feet wide, and 6 feet deep around Muscle Shoals; a canal $1\frac{1}{4}$ miles long around Elk River Shoals; in blasting a channel through the bed rock, and constructing of wing-dams at Little Muscle Shoals, and in removing the obstructions above Decatur and below Florence. Estimated cost, \$4,133,000, '70, 389; '73, 544; '77, i, 584; '86, 1510, 1513; '87, 1740.

Surveys.

Of Colbert and Bee Tree Shoals. Made, 1888, under direction of Lieut. Col. Barlow, '87, 1747.

MAPS.

'82, 1840.

TENSAS RIVER AND BAYOU, MACON, LA.—IMPROVEMENT OF.**Appropriations.**

1881	\$3, 000, '81, 1423.
1884	4, 000, '84, 1332.
1886	4, 000, '86, 1356.
1888	5, 000, act of August 11, 1888.

Contracts.

1884. Wooton & Brondway, for removal of obstructions, at \$125 per mile, '85, 1504.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 212, 213; '82, 209; '83, 218; '84, 223; '85, 236; '86, 232; '87, 197.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1880-'82. Reports, '81, 1422, 1457; '82, 1559.

Capt. A. M. Miller, 1882-'84. Reports, '83, 1160; '84, 1331.

Capt. E. Bergland, 1884-'87. Reports, '85, 1504; '86, 1355.

Capt. J. H. Willard. Report, '87, 1463.

ASSISTANT.

H. C. Wilson. Report, '81, 1458.

Operations.

1881-'82. 695 snags and 697 leaning trees removed, '82, 1557.

1882-'84. No operations for lack of funds, '83, 1160; '84, 1332.

1884-'85. 1,193 logs and snags removed from Tensas River by contract, '85, 1504.

1885-'86. No operations for lack of funds, '86, 1355.

1886-'87. Obstructions in Bayou Macon removed from Floyd's to junction with Tensas River, '87, 1464.

Physical Characteristics.

Description of river, '81, 1458.

Projects.

By Maj. Benyaurd, 1880, for the removal of snags, logs, and similar obstructions from the mouth to Dallas, a distance of 180 miles. Estimated cost, \$23,000, '81, 1457, 1461.

By the act of July 5, 1884, the improvement of Bayou Macon was united with that of Tensas River, '84, 400; '85, 1504.

Surveys.

Ordered by act of June 14, 1880. Made under direction of Maj. Benyaurd, 1880, '81, 1457.

*By act of July 5, 1881, the improvement of Bayou Macon, La., was united with that of the Tensas River, '84, 400; '85, 1504.

THAMES RIVER, CONN.—IMPROVEMENT OF.

(See also NEW LONDON HARBOR, CONN.)

(Continued from Vol. I, p. 546.)

Appropriations.

1821-'79	\$169,300
1880	'25,000, '80, 443.
1881	30,000, '81, 589.
1882	35,000, '82, 604.
1884	25,000, '84, 637.
1886	22,500, '86, 632.

Total	306,800
-------------	---------

1888	50,000, act of August 11, 1888.
------------	---------------------------------

Statement of appropriations, '81, 589; '87, 584.

Contracts.

1879. Morris and Cumings Dredging Company, for dredging, at 28 cents per cubic yard, '80, 443.

1880. W. Flannery, for dredging, at 23 cents per cubic yard, '81, 590.

1881. W. Flannery, for dredging, at 27 cents per cubic yard, annulled after repeated failures to complete, '82, 605.

1882. F. K. Ballou, for stone, at \$1.19 per ton, '82, 605. F. K. Ballou, for stone dike construction, at \$1.25 per ton, '84, 637. Hartford Dredging Company, for dredging, at 14½ cents per cubic yard, '84, 637. F. K. Ballou, for pile and stone dike construction, at \$4 per linear foot, '84, 637.

1884. C. H. Edwards, for stone dike construction, at \$1.07 per ton, '85, 640.

1887. J. A. Bouker, for stone dike construction, at 98 cents per ton, '87, 584. Hartford Dredging Company, for dredging, at 12 cents per cubic yard, '87, 585.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 77; '81, 90; '82, 91; '83, 85; '84, 92; '85, 81; '86, 82; '87, 43.

BOARD OF ENGINEERS.

Convened at New York March 14, 1882, to report upon project of Maj. Barlow for improvement of the Upper Thames. Report '82, 606. (Col. Z. B. Tower.)

ENGINEER IN CHARGE.

Maj. J. W. Barlow, 1877-'83. Reports, '80, 441; '81, 588; '82, 601.

Lieut. Col. W. McFarland, 1883-'86. Reports, '83, 503; '84, 636; '85, 638.

Lieut. Col. D. C. Houston, 1886-'—. Reports, '86, 629; '87, 582.

Operations.

1879-'80. 38,614 cubic yards material dredged from channel through the shoals, '80, 441.

1880-'81. 9,387 cubic yards material dredged from the bar, '81, 588.

1881-'82. 6,595 tons rip rap stone placed in training-wall, extending the same 750 feet, '82, 602.

1882-'83. 10,612 tons stone placed in dike, extending same 1,620 feet; 53,192 cubic yards material dredged, '83, 504.

1883-'84. 41,819 cubic yards sand dredged from channels; training-wall completed, '84, 636.

1884-'85. 11,254 tons stone placed in 2,500 linear feet of training-wall, '85, 640.

1885-'86. East dike completed by addition of 691 tons riprap; 8,000 tons stone delivered in the Rolling Mill Dike, '86, 630.

1886-'87. 4,479 tons stone placed in the Rolling Mill Dike; repairs to the Mohegan pile dike, '87, 582.

Projects.

In 1821 obstructions placed in the river during the war of 1812 were removed, '79, 333.

The first definite project for improving the river was that of 1836, which proposed, by dredging and the construction of wing-dams, to provide a channel 100 feet wide and 14 feet deep at high water; the desired results were obtained, but the shoals subsequently reformed, '73, 983; '86, 630.

The project of 1866 proposed the reformation, by dredging, of a channel 100 feet wide and 14 feet deep at high water, across the bars below Norwich. Estimated cost, \$65,000, '66, iv, 197; '68, 752; '73, 983.

In 1878 the project was modified to provide for a channel 100 feet wide and 14 feet deep at low water from Indian Point to Norwich. Estimated cost, \$75,000, '78, 396, 398. Increased in 1880 for removal of Middle Grounds at Norwich to \$101,000, '80, 442.

* \$2,500 to be applied to removal of shoal at New London, '81, 586.

THAMES RIVER, CONN.—Continued.**Projects—Continued.**

In 1882 the project was further modified so as to provide for increasing the width of channel to 200 feet over the first $3\frac{1}{4}$ miles below Norwich, together with the construction of training-walls if necessary for the rectification of the river.

Estimated cost, \$208,080, '82, 603; '87, 582.

Project approved by Board of Engineers, '82, 607.

Total amount appropriated from 1821 to 1886, inclusive, \$306,800. Amount required to complete project in 1886, \$105,580, '86, 631, 632; '87, 584.

Surveys.**MAPS.**

'82, 606, '84, 636; '85, 640.

THUNDER BAY HARBOR, MICH. (See ALPENA HARBOR.)**THUNDERBOLT RIVER, GA. (See SAINT AUGUSTINE CREEK, GA.)****TICKFAW RIVER, LA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 548.)

Appropriations.

1881.....	\$2,000, '81, 1285.
1882.....	2,000, '82, 1377.
1886.....	2,000, '86, 1245.
1888.....	1,000, act of August 11, 1888.

Contracts.

1881. W. Fagan, for removal of obstructions for a distance of 16 miles, at \$80 per mile, '82, 1377.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 145; '81, 193; '82, 190; '83, 208; '84, 211; '85, 217; '86, 215; '87, 181.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Report, '80, 1182.

Capt. W. H. Heuer, 1881-'82. Report, '81, 1284.

Maj. A. Stickney, 1882-'85. Reports, '82, 1376; '83, 1110; '84, 1271.

Maj. W. H. Heuer, 1885-'— . Reports, '85, 1396; '86, 1244; '87, 1362.

ASSISTANTS.

H. C. Collins. Reports, '80, 1183; '84, 1271.

Lieut. O. T. Crosby. Report, '87, 1363.

Operations.

1881-'82. 16 miles of river cleared of obstructions, '82, 1377.

1882-'83. No operations, '83, 1110.

1883-'84. 180 logs and snags and 791 trees removed, clearing 20 miles of river, '84, 1271.

1884-'86. No operations, '85, 1396; '86, 1245.

1886-'87. Obstructions cleared from navigable tributaries, '87, 1362.

Physical Characteristics.

Description of river, '80, 1183.

Projects.

By Maj. Howell, 1880, for improvement of the Tickfaw River from Van Buren Place to Natalbany and Pouchatoula rivers, a distance of 45 miles, by removal of snags, logs, and similar obstructions. Estimated cost, \$10,230, '80, 1184.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Howell, '80, 1182.

TICONDEROGA RIVER. N. Y.—IMPROVEMENT OF.**Appropriations.**

1881.....	\$5,000, '81, 726.
1882.....	5,000, '82, 714.
1886.....	2,000, '86, 350.
1888.....	2,500, act of August 11, 1888.

Contracts.

1882. L. Whitney, for dredging, at 22 cents per cubic yard, '82, 714.
 1884. C. H. De Lano, for dredging, at 20 cents per cubic yard, '84 2160.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '80, 90; '81, 114; '82, 115; '83, 325; '84, 329; '85, 356; '86, 350; '87, 316.

ENGINEERS IN CHARGE.

- Lieut. Col. N. Michler, 1880-'82. Report, '81, 726.
 Maj. G. L. Gillespie, 1882-'83. Report, '82, 713.
 Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 1960; '84, 2160.
 Maj. M. B. Adams, 1885-'— . Reports, '85, 2310; '86, 1905; '87, 2410.

ASSISTANT.

- D. White. Report, '81, 727.

Operations.

- 1881-'82. Channel 42 feet wide and 6 feet deep dredged from the lake to Cassey's Wharf, '82, 713.
 1882-'83. 14,981 cubic yards material dredged from the channel, '83, 1960.
 1883-'87. No operations, '84, 2160; '85, 2310; '86, 1905; '87, 2411.

Projects.

- By Lieut. Col. Michler, 1880, for improvement of Ticonderoga River, by excavation of a channel 100 feet wide and 8 feet deep from the 6-foot curve in Lake Champlain to the railroad bridge thence 60 feet wide to the foot of the falls at Ticonderoga; also to widen the channel in front of Cassey and Bishop's docks to 100 feet and to extend a cut 100 feet wide diagonally across the basin. Estimated cost, \$42,516, '81, 728, 729.

Surveys.

- Ordered by act of June 14, 1880. Made, 1881, under direction of Lieut. Col. Michler, '81, 726.

MAPS.

- '87, 2411.

TILLAMOOK BAY AND BAR, OREG.

- Examination ordered by act of August 5, 1886, '87, 330. [\$5,200 appropriated by act of August 11, 1888.]

TIONESTA CREEK, PA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

- Report, '84, 263.

ENGINEER IN CHARGE.

- Maj. W. E. Merrill. Report, '84, 1704.

ASSISTANT.

- I. V. Hoag, jr. Report, '84, 1704.

Plans.

- Maj. Merrill, 1883, estimates \$1,000 as cost of removal of boom piers at lower portion of creek, but does not consider the improvement as one of public necessity, '84, 1704.

Surveys.

- Examination ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Merrill, '84, 1704.

TOLEDO HARBOR, OHIO—IMPROVEMENT OF.

(Continued from Vol. I, p. 548.)

Appropriations.

1886-'79	\$564,700
1880. Old channel.....	30,000, '80, 2099.
1881. Old channel.....	40,000, '81, 2284.
1882. Old channel.....	50,000, '82, 2382.
1884. Old channel.....	20,000, '84, 2086.
Total	704,700
1888. Old channel.....	5,000, act of August 11, 1888.
1884. Straight channel....	*25,000, '84, 2086.
1886. Straight channel....	112,500, '86, 1853.
1888. Straight channel....	150,000, act of August 11, 1888.

Commerce.

Growth of commerce and demand for increased facilities, '80, 2097, 2098; '81, 2287; '87, 2290.

Contracts.

1879. E. H. French, for dredging, at 9½ cents per cubic yard, '80, 2099.
 1880. E. H. French, for dredging, at 14 cents per cubic yard, '81, 2285. E. H. French, for dredging, at 19 cents per cubic yard, '81, 2285.
 1881. Symmes & Scandlon, for dredging, at 15 cents per cubic yard, '81, 2285.
 1882. S. A. Murphy, for removal of scow and cargo, '82, 2383. E. H. French, for dredging, at 21 cents per cubic yard, '83, 1892.
 1884. E. H. French, for dredging, at 15½ cents per cubic yard, '85, 2215. W. E. Rooney, for dredging, at 14½ cents per cubic yard, '85, 2215.
 1885. G. Talbot, for dredging, at 10 cents per cubic yard, '86, 1853.
 1886. Carlin, Stickney & Cram, for dredging, at 16½ cents per cubic yard, '87, 2287.
 1887. George Kellogg, for dredging, at 12 cents per cubic yard, '87, 2286. French & Rooney, for dredging, at 15 cents per cubic yard, '87, 2286.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 223, 229; '81, 304, 314, 315; '82, 299, 309; '83, 306; '84, 309; '85, 333; '86, 327; '87, 295.

BOARD OF ENGINEERS.

Board of Engineers convened at New York April 12, 1887, to consider location of proposed straight channel for improving Toledo Harbor. Report, '87, 2295. (Cols. Casey, Abbot and Craighill, Lieut. Cols. Houston and McFarland, and Maj. King.)

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2092; '81, 2281, 2286; '82, 2379, 2383. Maj. L. C. Overman, 1883-'— Reports, '83, 1889; '84, 2083; '85, 2211; '86, 1849; '87, 2283, 2291.

Operations.

History of the work, '80, 2093.

- 1879-'80. 126,649 cubic yards material dredged from the channel, '80, 2097.
 1880-'81. 167,453 cubic yards material dredged from the channel, '81, 2283.
 1881-'82. 94,385 cubic yards material dredged from the channel; wreck of scow Wellhouse removed, '82, 2381.
 1882-'83. 229,070 cubic yards material dredged from the channel, '83, 1890.
 1883-'84. 78,345 cubic yards material dredged from the channel, '84, 2084.
 1884-'85. 155,085 cubic yards material dredged from the channel, '85, 2211.
 1885-'86. 127,260 cubic yards material dredged from the straight channel, '86, 1851.
 1886-'87. 45,397 cubic yards material dredged from old channel, '87, 2284.

Plans.

By Maj. Wilson, 1881, for extension of Maumee River on a straight line through the bay and North Cape Point to Lake Erie, confining the river-bed in a new channel of about the same dimensions as its natural bed, by dredging in the bay and the lake and the construction of two parallel lines of revetment on either side of the channel. Estimated cost, \$2,363,923, '82, 2385, 2386; '86, 1850; '87, 2291, 2296.

By Maj. Overman, 1887, for a channel beginning at mouth of Maumee River and extending straight through North Cape Point on a course North 26° 36' 13" East to 17 feet depth of water in lake Erie, Ottawa River to be diverted by a cut through North Cape Peninsula; the revetment of the cut to be determined by experience, '87, 2294, 2296. Plan considered by Board of Engineers, '87, 2295.

* Balance of \$9,632.61 to be applied to clearing old channel, '86, 447, 1852; '87, 2295.

TOLEDO HARBOR, OHIO—Continued.**Projects.**

The original project of 1866 proposed the deepening, by dredging, of the natural channel in Maumee Bay for a distance of about 1 mile to a width of 200 feet and a depth of 12 feet, '66, iii, 6, 33; iv, 38.

The Board of Engineers in 1869 recommended the adoption of the present location of channel. Estimated cost, \$152,800, '69, 118, 125, 127; '80, 2093.

In 1872 a Board of Engineers submitted three plans, of which the Secretary of War approved that which provided for the widening of the existing channel to 250 feet at the top with a depth of 15 feet, at an estimated cost of \$450,000, '73, 313-324; '77, 953; '80, 2094.

In 1880 the proposed depth was increased to 16 feet, '80, 2097; '87, 2285.

In 1886 there had been obtained a channel 200 feet wide at bottom, and from 15 to 17 feet deep between Toledo and deep water in the lake, under an aggregate of appropriation from 1866 to 1884, inclusive, of \$704,700, '86, 327, 1850; '87, 2283.

In 1887 a Board of Engineers recommended a straight cut from the mouth of the Maumee River to Lake Erie by extending the crib reach at the present natural channel outward into the lake and inward across the bay to the present natural channel of the river, thereby utilizing about 2 miles of the previously improved channel, the channel to have a depth of 17 feet with a bottom width of 200 feet. Estimated cost, \$1,875,000, '87, 2286, 2297. Approved by Secretary of War, '87, 2299.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Maj. Wilson, for a depth of 16 feet, '81, 2286.

Ordered by act of March 3, 1881. Made, 1881, under direction of Maj. Wilson, for a straight channel to Lake Erie, '82, 2383.

Resurvey made under direction of Maj. Overman, 1886, '87, 2285, 2291.

TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.—IMPROVEMENT OF.

(See BLACK WARRIOR RIVER, ALA., AND TOMBIGBEE RIVER ABOVE COLUMBUS, MISS.)

(Continued from Vol. I, p. 550.)

Appropriations.

1870-'79	\$120,000	
1880.	{ Black Warrior.....	20,000	'80, 1090.
	{ Tombigbee between Columbus and Vienna...	12,000	
	{ Tombigbee below Vienna.....	15,000	
1881.	{ Warrior and Tombigbee.....	25,000	'81, 1211.
	{ Warrior below Tuscaloosa.....	10,000	
1882.	{ Tombigbee between Columbus and Vienna.....	7,500	'82, 1294.
	{ Tombigbee between Vienna and Demopolis.....	7,500	
	{ Tombigbee below Demopolis.....	5,000	
	{ Tombigbee from Fulton to Vienna.....	10,000	
1884.	{ Tombigbee below Fulton.....	15,000	'84, 1210.
	{ Warrior River.....	12,000	
	{ Warrior below Tuscaloosa.....	18,750	
	{ Tombigbee below Vienna.....	11,250	
1886.	{ Tombigbee between Vienna and Fulton....	7,500	'86, 1199.
	Total.....	296,500	
1888.	{ Tombigbee from Walker's Bridge to Fulton.....	4,000	} act of August 11, 1888.
	{ Tombigbee from Fulton to Vienna.....	6,500	
	{ Tombigbee below Vienna.....	6,000	
Statement of appropriations, '83, 1019; '84, 1210; '86, 1198.			

Commerce.

Benefit of improvement, '81, 1205, 1208, 1210; '82, 1294; '83, 1015; '85, 1348.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 138; '81, 186; '82, 183; '83, 195; '84, 203; '85, 208; '86, 206; '87, 173, 174, 178.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1875-'—. Reports, '80, 1085; '81, 1203; '82, 1282; '83, 1011; '84, 1204; '85, 1345; '86, 1193; '87, 1322.

TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.—Continued.**Operations.**

History of operations, '80, 1036; '82, 1283, 1288.

All operations by hired labor.

1879-'80. No operations on Black Warrior River, '80, 1086. Obstructions removed and wing-dams built on Tombigbee between Columbus and Demopolis, '80, 1088; '82, 1288.

1880-'81. 586 trees and logs removed and 851 linear feet wing-dams built on the Black Warrior River, '81, 1204. On Tombigbee River, between Columbus and Vienna, 5,656 linear feet of wing-dams built, 1,541 linear feet shore protection placed, and 2,482 trees and logs removed, '81, 1207.

1881-'82. On the Black Warrior, 10,111 linear feet of dams and jetties built, 4,608 logs and trees removed, '82, 1284. On the Tombigbee, below Columbus, 9,336 linear feet of wing-dams built, 6,406 logs and trees removed, 1,100 cubic yards rock blasted, '82, 1290.

1882-'83. On the Black Warrior, 7,969 linear feet jetties built and repaired, 3,200 linear feet bank protected, 2,607 trees and logs removed, '83, 1014. On the Tombigbee, below Columbus, 1,020 linear feet wing-dams built, 5,281 trees and logs, and 1,900 cubic yards of rock removed, '83, 1018.

1883-'84. On Black Warrior, 1,354 logs and trees removed, '84, 1204. On Tombigbee, below Columbus, 800 snags and trees removed and 1,685 linear feet of wing-dams built, '84, 1208.

1884-'85. On Black Warrior, 567 trees and snags removed and 500 cords of brush cut and piled, '85, 1346. On the Tombigbee a barge was built, 6,027 trees and logs removed, and one-half mile of bank protected, '85, 1350.

1885-'86. On Black Warrior, 250 logs removed and caving bank protected, '86, 1193. On the Tombigbee, 1,333 logs and trees were removed, '86, 1197.

1886-'87. On the Warrior River a survey in progress, '87, 1324. On Tombigbee River no operations, '87, 1326.

Physical Characteristics.

Caving banks on Tombigbee River, '80, 1089.

Black Warrior River described, '83, 1011.

Discharge of Black Warrior, '85, 1347.

Projects.

By Maj. Damrell, 1875, for the formation of a channel 80 feet wide and 4 feet deep in the Black Warrior River, from the mouth to Tuscaloosa, 140 miles, by the removal of obstructions, dredging, blasting, and construction of wing-dams. Estimated cost, \$151,103, '75, i, 17; '80, 1085.

The projects of 1871 to 1879, for the improvement of the Tombigbee proposed the formation of a 4-foot channel from the mouth to Demopolis, and from thence a 3-foot channel to Columbus, by the removal of obstructions, dredging, and construction of wing-dams. Estimated cost, \$170,000, '79, 832; '80, 1088.

TOMBIGBEE RIVER, ABOVE COLUMBUS, MISS.—IMPROVEMENT OF.

(See **TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.**)

Appropriations.

1880..... \$4,000, '80, 1092.

1881..... 1,000, '81, 1212.

1882..... 1,000, '82, 1295.

Statement of appropriations, '82, 1295.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 139; '81, 187; '82, 184; '83, 196; '84, 204.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1880-'84. Reports, '80, 1091; '81, 1211; '82, 1294, 1312; '83, 1022; '84, 1210.

ASSISTANT.

H. Harding. Report, '82, 1313.

Operations.

All operations by hired labor.

1879-'80. Removal of snags and logs, '80, 1091.

1880-'81. 9,074 logs, trees, and stumps removed, '81, 1212.

1881-'82. Removal of snags and logs, '82, 1295.

1882-'84. Preservation of work, '83, 1022; '84, 1211.

TOMBIGBEE RIVER, ABOVE COLUMBUS, MISS.—Continued.• **Plans.**

By Maj. Damrell for an improvement between Fulton and the junction of Brown's and Mackey's creeks by removal of logs, snags, and trees. Estimated cost, \$11,000, '82, 1312, 1313.

Projects.

By Maj. McFarland, 1873, for the temporary improvement of the Tombigbee above Columbus and to Fulton by removal of obstructions. Estimated cost, \$35,000, '73, 548; '80, 1092; '81, 1211. Project completed, 1882, '82, 1295.

Surveys.

1882. From Fulton to Warren's Mill, under direction of Maj. Damrell, '82, 1312.

TONAWANDA CREEK, N. Y. (See NIAGARA RIVER AT MOUTH OF.)**TONAWANDA HARBOR, N. Y. (See NIAGARA RIVER.)****TONES BAYOU, LA. (See RED RIVER, LA. AND ARK.)****TORCH LAKE CHANNEL, Lake Superior, Mich.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '87, 266.

ENGINEER IN CHARGE.

Capt. C. E. L. B. Davis, 1886. Report, '87, 2053.

Physical Characteristics.

Dimensions of lake, '87, 2053.

Plans.

Capt. Davis reports, 1886, unfavorably to any work of improvement in view of the entirely local nature of commerce to be benefited, '87, 2054.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Capt. Davis, '87, 2053.

TOTUSKEY RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 552.)

Appropriations.

1880.....	\$2,500, '80, 769.
1881.....	2,500, '81, 966.
1882.....	5,000, '82, 1029.

Statement of appropriations, '87, 939.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 114; '81, 154; '82, 149; '83, 155; '84, 157; '85, 147; '86, 142; '87, 109.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1875.—. Reports, '80, 768; '81, 964; '82, 1027; '83, 813; '84, 988; '85, 976; '86, 913; '87, 938.

Operations.

1882-'83. 2,117 linear feet pile dike built, '83, 814.

1883-'87. No operations, '84, 988; '85, 977; '86, 914; '87, 938.

TOTUSKEY RIVER, VA.—Continued.**Projects.**

By S. T. Abert, 1875, for excavation of channel 60 feet wide and 8 feet deep through Brooker's Bar, and the construction of 2,400 linear feet of dike parallel with channel. Estimated cost, \$14,960, '75, ii, 160. Total amount appropriated from 1880 to 1882, inclusive, \$10,000. Amount estimated to complete project, \$12,000, '87, 939.

TOWN CREEK, N. C.—IMPROVEMENT OF.**Appropriation.**

1881..... \$1,000, '81, 1023.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 165; '83, 168; '84, 177.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'83. Report, '81, 1023, 1024.

Capt. J. Mercur, 1883-'— Reports, '83, 862; '84, 1063.

ASSISTANTS.

J. P. Darling. Report, '81, 1024.

W. H. James. Report, '83, 863.

Operations.

1882-'83. Two sunken flats blown up and removed from the channel; also 385 snags, stumps, and trees taken out and dredging done, '83, 863.

Projects.

By Capt. Phillips, 1881, for improvement of Town Creek from its mouth to Saw Pit Landing, by excavation of a channel 60 feet wide and 4 feet deep at low water, through 4 shoals, and removal of snags, logs, and similar obstructions. Estimated cost, \$9,078.48, '81, 1025.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Phillips, '81, 1024.

Ordered by act of August 2, 1882. Made, 1883, under direction of Capt. Mercur, '84, 1063. Reported as not worthy of further improvement.

MAPS.

'83, 862.

TOWNSHEND INLET AND CORSON'S SOUND, N. J.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 126.

ENGINEER IN CHARGE.

Maj. W. H. Heuer, 1884. Report, '85, 858.

Plans.

Maj. Heuer, 1884, does not consider the localities worthy of improvement, '85, 860.

Surveys.

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Maj. Heuer, '85, 858.

TRADEWATER RIVER, KY.—IMPROVEMENT OF.**Appropriations.**

1881..... \$3,000, '82, 1959.

1882..... 3,500, '82, 1962.

1884..... 2,000, '84, 1748.

1886..... 2,000, '86, 1618.

Total 10,500

1888..... 6,000, act of August 11, 1888.

TRADEWATER RIVER, KY.—Continued.**Commerce.**

Development of commerce due to improvement, '85, 1884.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 197; '81, 265; '82, 260; '83, 268; '84, 264; '85, 289; '86, 284; '87, 248.

ENGINEERS IN CHARGE.

Maj. J. W. Cuyler, 1880-'83. Reports, '81, 1991; '82, 1959.

Maj. J. C. Post, 1883-'87. Reports, '83, 1574; '84, 1747; '85, 1883; '86, 1617.

Maj. A. Stickney, 1887-'—. Report, '87, 1895.

ASSISTANT.

A. L. Duvall. Reports, '81, 1992; '82, 1962; '84, 1748.

Operations.

1881-'82. 435 cubic yards rock blasted, 633 snags removed, and 3,033 trees cut and deadened, '82, 1963.

1882-'83. No operations, '83, 1575.

1883-'84. 2,446 stumps, logs, and snags removed and 18,711 trees cut and deadened, '84, 1749.

1884-'85. 1,222 logs and snags removed and 42,703 trees cut and girdled, '85, 1884.

1885-'86. No operations, '86, 1617.

1886-'87. Removal of obstructions to Fish Trap Ford, '87, 1895.

Physical Characteristics.

Description of the river, '81, 1991.

Projects.

By Capt. Cuyler, 1880, for improvement of descending navigation on the Tradewater River by removal of snags, logs, and similar obstructions, and excavation of channel through natural rock barrier at mouth of river, so as to give a channel 40 feet wide and at least 2½ feet deep. Estimated cost, \$10,000, '81, 1994.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Cuyler, '81, 1991.

TREADHAVEN CREEK, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 560.)

Appropriations.

1880..... \$3,000, '80, 640.

1881..... 3,000, '81, 881.

Commerce.

Commerce on the creek, '80, 639.

Contracts.

1880. American Dredging Company, for dredging, at 20 cents per cubic yard, '81, 881.

1881. American Dredging Company, for dredging, at 22 cents per cubic yard, '81, 882.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 103, 110; '81, 138; '82, 133; '83, 138.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill, 1879-'83. Reports, '80, 638; '81, 880; '82, 853; '83, 679.

Operations.

1880-'81. 27,094 cubic yards dredged from the channel, '81, 881.

1881-'83. No operations, '83, 679.

Projects.

By Lieut. Col. Craighill, 1879, for improvement of Treadhaven Creek for a distance of 3 miles below Easton, by excavation of an 8-foot mean low-water channel 150 feet wide. Estimated cost, \$8,250, '80, 639.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Craighill, '80, 638.

TRENTON HARBOR, LA.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 227.

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '84, 1383.

ASSISTANT.

E. F. White. Report, '84, 1382.

Plans.

In 1883 Maj. Miller did not consider the locality worthy of improvement, '84, 1381.

Surveys.

Examination ordered by act of August 2, 1882. Made under direction of Maj. Miller, '84, 1341.

TRENT RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 560.)

Appropriations.

1879.....	\$7,000
1880.....	10,000, '80, 840.
1881.....	5,000, '81, 1007.
1882.....	10,000, '82, 1089.
1884.....	10,000, '84, 1041.
1886.....	3,500, '86, 978.

Total 45,500

1888..... 5,000, act of August 11, 1888.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 123; '81, 163; '82, 158; '83, 165; '84, 171; '85, 165; '86, 160; '87, 125.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1878-'81. Report, '80, 838.

Capt. J. Merour, 1881-'84. Reports, '81, 1007; '82, 1088; '83, 853.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1041.

Capt. W. H. Bixby, 1885-'— Reports, '85, 1032; '86, 966; '87, 1016.

ASSISTANTS.

R. Ransom. Reports, '80, 840; '81, 1008; '82, 1089; '83, 853; '84, 1041; '85, 1063; '86, 978; '87, 1018.

E. Thompson. Report, '87, 1019.

Operations.

1879-'80. Two cut-offs opened and widened, and snags, logs, and similar obstructions removed from Quaker Bridge to Trenton, '80, 840.

1880-'81. Logs, snags, stumps, and similar obstructions removed between Quaker Bridge and Pollocksville, '81, 1008.

1881-'82. 18,000 cubic yards material dredged from the channel, '82, 1089.

1882-'83. 1,600 trees removed from the banks and 73 logs from the channel, '83, 853.

1883-'84. 25,000 cubic yards material dredged from basin and channel; 460 logs, snags, and stumps removed, '84, 1041.

1884-'85. Turning-basin at Trenton completed by solid revetment wall, and by dredging of basin to 6 feet low water; 617 logs and stumps removed from river, '85, 1062.

1885-'86. No operations, '86, 977.

1886-'87. Minor obstructions removed, '87, 1017.

Projects.

By Capt. Phillips, 1879, for the improvement of the river below Trenton to secure a depth of 3 feet at the extreme low summer stage of the river, by removal of snags, fallen and leaning trees, by dredging, and by dike and dam construction. Estimated cost, \$22,000, '79, 711, 714. Estimate increased in 1885 and 1887 to \$59,000, '87, 1017.

TRINIDAD HARBOR, CAL.—EXAMINATION FOR HARBOR OF REFUGE AT.

(See also HARBOR OF REFUGE ON PAACIFIC COAST.)

(Continued from Vol. I, p. 561.)

Commerce.

Prospective commercial importance of Trinidad as a harbor of refuge, '80, 2249.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 237.

ENGINEER IN CHARGE.

Lient. Col. C. S. Stewart. Report, '80, 224.

Plans.

By Lient. Col. Stewart, 1880, for formation of a harbor of refuge at Trinidad, by construction of a stone and concrete breakwater from Trinidad Head to Pilot Rock, a distance of 900 yards. Estimated cost, \$5,293,237, '80, 2250.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lient. Col. Stewart, '80, 224.

MAPS.

'80, 2250.

TRINITY RIVER, TEX.—IMPROVEMENT OF.

(Continued from Vol. I, p. 561.)

Appropriations.

1852-'79	\$19,000
1880	4,000, '80, 1239.
1881	10,000, '81, 1342.
1882	8,000, '82, 1458.

Total 41,000

1888..... 12,500, act of August 11, 1888.

Contracts.

1881. G. L. Long, for dredging and snag removal, '81, 1341.

1884. J. S. Atkinson, for sheet-pile revetment and dredging, the former at \$3 per linear foot and the latter at 15 cents per cubic yard, '85, 1456.

Engineers.

CHIEF OF ENGINEERS.

Reports, '80, 148; '81, 200; '82, 197; '83, 202; '84, 217; '85, 227; '86, 224; '87, 189.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1880-'81. Report, '80, 1238, 1239.

Capt. C. E. L. B. Davis, 1881-'82. Report, '81, 1340.

Maj. S. M. Mansfield, 1882-'86. Reports, '82, 1457; '83, 1082; '84, 1304; '85, 1455; '86, 1323.

Maj. O. H. Ernst, 1886-'—. Report, '87, 1421.

ASSISTANT.

W. L. Webb. Report, '80, 1240.

Operations.

1879-'80. 22,000 cubic yards of material dredged from bar at mouth, '80, 1239.

1880-'81. 25,000 cubic yards material dredged from bar at mouth, '81, 1341.

1881-'82. 29,000 cubic yards sand dredged; 58 snags and trees and 1 wreck removed, '82, 1458.

1882-'84. No operations, '83, 1082; '84, 1304.

1884-'85. 2,775 linear feet of revetment built and 23,275 cubic yards material dredged, '85, 1456.

1885-'87. No operations, '86, 1324; '87, 1421.

Physical Characteristics.

General description of the river, '87, 1240.

Projects.

By Capt. Howell, 1871 and 1873, for improvement of Trinity River, securing a 5-foot channel from the mouth up to Liberty, by construction of pile breakwater at the mouth, removal of snags, and dredging. Estimated cost, \$46,000, '71, 537; '73, 685; '80, 1238. Increased in 1887 to \$59,500, '87, 1422.

Surveys.

Resurvey ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Mansfield, '80, 1239.

TUCKAHOE CREEK, MD.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 110; '85, 137.

ENGINEERS IN CHARGE.

Lieut. Col. W. P. Craighill, 1879. Report, '80, 736.

W. F. Smith, U. S. Agent, 1884. Report, '85, 908, 909, 911.

ASSISTANTS.

J. L. Seager. Report, '80, 737.

T. I. George. Report, '85, 910.

Physical Characteristics.

Description of creek, '80, 737.

Plans.

By Lieut. Col. Craighill, 1880, for improvement of Tuckahoe Creek from the mouth to Hillsborough, by excavating a channel 200 feet wide and 8 feet deep at low water from Hillsborough to Wayman's, and one 6 feet deep and 75 feet wide from the latter place to the mouth. Estimated cost, \$41,250, '80, 738.

By W. F. Smith, for improvement of Tuckahoe Creek from Wayman's Wharf to Hillsborough, by excavation of an 8-foot low-water channel 75 feet wide, cost, \$55,575; or a similar channel 60 feet wide, cost, \$46,200, '85, 910.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Lieut. Col. Craighill, '80, 736.

Examination and survey ordered by act of July 5, 1884. Made, 1884-'85, under direction of W. F. Smith, '85, 908, 909.

TUGUE CREEK, MO.—SURVEY OF.

(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)

TWO RIVERS HARBOR, WIS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 563.)

Appropriations.

1871-'79	\$140,000
1880	20,000, '80, 1915.
1881	15,000, '81, 2090.
1882	15,000, '82, 2144.
1884	8,000, '84, 1852.
Total	198,000
1888	2,500, act of August 11, 1888.

Contracts.

1880. Truman & Cooper, for pier extension, '81, 2091.

1881. Knapp & Gillen, for pier extension, '81, 2091.

1882. Truman & Cooper, for pier extension, '83, 1686.

1884. Truman & Cooper, for superstructure construction, '85, 1996.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 205; '81, 277; '82, 273; '83, 281; '84, 281; '85, 304; '86, 298; '87, 263.

ENGINEERS IN CHARGE.

Lieut. Col. H. M. Roberi, 1875-'83. Reports, '80, 1914; '81, 2088; '82, 2143.

Capt. F. A. Hinman, 1883-'84. Report, '83, 1685.

Lieut. Col. J. W. Barlow, 1884-'86. Reports, '84, 1851; '85, 1995.

Capt. W. L. Marshall, 1886; '86, 290.

Capt C. E. L. B. Davis, 1886-'—. Reports, '86, 1665; '87, 2043.

ASSISTANT.

L. Y. Schermerhorn. Report, '81, 2091.

TWO RIVERS HARBOR, WIS.—Continued.**Operations.**

- 1879-'80. 7 cribs built and 1 sunk in extension of north pier; 49,801 cubic yards material dredged from the channel between the piers; 320 linear feet of double and 446 feet of single sheet-piling on north pier; 153 linear feet of pile revetment capped; 208 cords of stone used in pier, '80, 1915.
- 1880-'81. 15 cribs sunk and 4 built in extension of the north pier, '81, 2069.
- 1881-'82. 4 cribs placed in extension of north pier and 2 in extension of south pier; 20,594 cubic yards material dredged from the channel; 14,000 cubic yards material dredged by city, '82, 2143, 2144.
- 1882-'83. Partial superstructure built over 500 linear feet of south pier and 100 linear feet of extension added to same; 26,436 cubic yards material dredged from river between the piers, '83, 1685.
- 1883-'84. No operations, '84, 1851.
- 1884-'85. 33,395 cubic yards material dredged from the channel, '85, 1995.
- 1885-'86. 26,663 cubic yards material dredged from the channel; 345 linear feet of sand fence built; 41 cords stone filling placed in pier, '86, 1666.
- 1886-'87. No operations, '87, 2043.

Private and Corporate Work.

14,000 cubic yards material dredged from the inner harbor by the city of Two Rivers, '82, 2144.

Projects.

By Maj. Houston, 1870, for improvement of the harbor by construction of two parallel piers 260 feet apart and extending to the 18-foot curve in the lake, and dredging between them to a depth of 12 feet; length of piers, 1,810 and 1,710 feet, respectively. Estimated cost, \$265,588.80, '71, 111; '74, i, 144; '75, i, 200; '86, 1665, 1666.

In 1877 the project was modified to provide for a sand-tight revetment to the pile-piers, '77, 860; '78, 1156; '79, 1512, 1514.

Total amount appropriated from 1871 to 1886, inclusive, \$198,000. Estimated cost of completion of project, \$67,588, '86, 298.

Surveys.

Of Two Rivers Harbor, 1881, '81, 2091.

MAPS.

'81, 2090.

UMPQUA RIVER, OREG.—IMPROVEMENT OF.

(Continued from Vol. I, p. 564.)

Appropriations.

1871-'79.....	\$22,500.00
1886.....	1.47, '86, 443.
1888.....	2,000.00, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 242; '86, 363; '87, 326, 330.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1879-'80. Report, '80, 2333.

Capt. C. F. Powell, 1886-'— . Reports, '86, 2005; '87, 2463, 2499.

ASSISTANTS.

R. A. Habersham. Report, '80, 2234.

J. S. Poihemus. Report, '87, 2463.

Operations.

1872-'85. Operations suspended, '86, 2005.

1885-'86. Blasting and rock removal commenced on the river under appropriation of 1871, '86, 2006.

1886-'87. Rock removal in progress on reefs below Scottsburgh, '87, 2463.

Physical Characteristics.

Description of the river, '80, 2334; '87, 2499.

Plans.

By Maj. Gillespie, 1879, for the improvement of Umpqua River between Scottsburgh and its mouth by removal of bars at Brandy and Echo islands and Dean's Creek, involving construction of 3,100 linear feet of crib-jetty, at an estimated cost of \$11,110, '80, 2336.

In 1887, Capt. Powell, for the formation of a 4-foot channel from Gardner to Scottsburgh by contraction works on two bars, removal of bowlders, and completion of present project at Scottsburgh Reefs. Estimated cost, \$30,000, '87, 2500.

UMPQUA RIVER, OREG.—Continued.**Projects.**

By Maj. R. S. Williamson, for improvement of Umpqua River by removal of obstructions to a high-water navigation from Scottsburgh to Roseburgh. Estimated cost, \$22,549, '71, 912; '86, 2005.

In 1886 the project proposed the expenditure of the balance of the appropriation of 1871 near and below Scottsburgh, '86, 2005; '87, 326.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Gillespie, '80, 2333.

Examination ordered by act of August 5, 1886. Made under direction of Capt. Powell, '87, 2499.

UPPER COLUMBIA RIVER. (See COLUMBIA RIVER, UPPER.)**UPPER MISSISSIPPI RIVER—REMOVAL OF OBSTRUCTIONS FROM.**

(See MISSISSIPPI RIVER, UPPER.)

UPPER SAINT JOHN'S RIVER, FLA. (See SAINT JOHN'S RIVER, UPPER.)**UPPER SYNEPUXENT BAY, MD.** (See ISLE OF WIGHT BAY.)**UPPER WILLAMETTE RIVER.** (See WILLAMETTE RIVER, UPPER.)**URBANA CREEK, VA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 565.)

Appropriations.

1879.....	\$5,000
1880.....	2,500, '80, 770.
1881.....	4,000, '81, 967.
1882.....	4,000, '82, 1031.

Total..... 15,500

Statement of appropriations, '87, 940.

Contracts.

1879. T. P. Morgan, for dredging, at 24 cents per cubic yard, '80, 769.

1880. National Dredging Company, for dredging, at 30 cents per cubic yard, '81, 967.

1881. Potomac Dredging Company, for dredging, at 29½ cents per cubic yard, '82, 1030.

1882. D. Constantine, for dredging, at 15 cents per cubic yard, '83, 816.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 114; '81, 154; '82, 149, 154; '83, 155; '84, 158; '85, 143; '86, 143; '87, 109.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent, 1875—'. Reports, '80, 769; '81, 966; '82, 1029, 1032; '83, 815; '84, 990; '85, 977; '86, 914; '87, 939.

URBANA CREEK, VA.—Continued.**Operations.**

- 1879-'80. 16,991 cubic yards material dredged from the bar, '80, 770.
 1880-'81. No operations, '81, 966.
 1881-'82. 11,870 cubic yards material dredged from the channel, '82, 1031.
 1882-'83. 5,900 cubic yards material dredged from the bar at mouth, '83, 816.
 1883-'84. 6,083 cubic yards material dredged from the bar, '84, 990.
 1884-'87. No operations, '85, 978; '86, 915; '87, 940.

Projects.

By S. T. Abert, 1875, for improvement of creek by excavation of a channel 150 feet wide and 10 feet deep at mean low water through the bar at its mouth, at an estimated cost of \$20,000, '75, ii, 141; '79, 616; '86, 915.

Project extended in 1883 to include removal of bar in the harbor, increasing the total estimate to \$22,000, '84, 990; '87, 939.

Surveys.

From the village of Urbana to the Oaks ordered by act of June 14, 1880. Made, 1882, under direction of S. T. Abert, '82, 1032.

VANDALIA, LA. (See MISSISSIPPI RIVER BETWEEN MOUTH OF OHIO AND HEAD OF THE PASSES.)**VERMILLION, DAK. (See MISSOURI RIVER BETWEEN SIOUX CITY AND FORT BENTON.)****VERMILLION HARBOR, OHIO—IMPROVEMENT OF.**

(Continued from Vol. I, p. 566.)

Appropriations.

1836-'79	\$113,701.28
1880	2,000.00, '80, 2126.
1881	2,000.00, '81, 2306.
1882	3,000.00, '82, 2396.
1886	3,000.00, '86, 1861.

Total	123,701.28
1888	1,000.00, act of August 11, 1888.

Contracts.

1880. J. Sims, for dredging, at 30 cents per cubic yard, '81, 2306.
 1886. L. P. & J. A. Smith, for repair to piers, '87, 2312.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 225; '81, 308; '82, 302; '83, 313; '84, 313; '85, 338; '86, 332; '87, 299.

ENGINEERS IN CHARGE.

Maj. J. M. Wilson, 1878-'83. Reports, '80, 2124; '81, 2304; '82, 2394.
 Maj. L. C. Overman, 1883-'—. Reports, '83, 1901; '84, 2093; '85, 2222; '86, 1859; '87, 2310.

Operations.

- History of the work, '80, 2122.
 1879-'80. Minor repairs to piers, '80, 2125.
 1880-'81. 5,656 cubic yards shale rock dredged from channel, '81, 2305.
 1881-'82. 125-foot breach in east pier repaired; 66 linear feet east pier superstructure rebuilt, '82, 2395.
 1882-'83. Crib built and sunk in repair of west pier, '83, 1901.
 1883-'84. 106 linear feet of west pier removed and rebuilt; 330 linear feet superstructure repaired, '84, 2093.
 1884-'86. No operations, '85, 2222; '86, 1860.
 1886-'87. Repairs to piers, '87, 2310.

VERMILLION HARBOR, OHIO—Continued.**Projects.**

The earliest project, 1836, proposed the extension of two parallel piers from each side of the river mouth to the 10-foot curve in the lake. In 1838 the project was amended to provide for dredging between the piers. The project was subsequently amended to provide for an increase of depth to 12 feet, involving rock removal from the channel between the piers, '66, i, 27; '72, 223; '73, 332; '74, i, 219; '77, 960; '80, 2122.

In 1880 the project was expanded to provide for an increase of channel depth to 14 feet from deep water in the lake to the city wharves, '80, 2126; '86, 1860.

Total amount appropriated from 1836 to 1886, inclusive, \$123,701.28. Estimated cost of completion of existing project, \$11,000, '86, 1860, 1861; '87, 2311.

Surveys.**MAPS.**

'81, 2304.

VERMILLION RIVER, LA.—IMPROVEMENT OF.**Appropriations.**

1880..... \$5,000, '80, 1158.

1881..... 4,900, '81, 1282.

Commerce.

Increase of commerce due to improvement, '83, 1106.

Prospective benefit of improvement, '87, 1401.

Contracts.

1881. G. A. Maguire, for clearing 22 miles of river for \$4,750, '81, 1281. J. Maguire, for construction of a brush dam and clearing 27½ miles of river, '82, 1373.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 143, 145; '81, 192; '82, 189; '83, 207; '87, 188.

ENGINEERS IN CHARGE.

Maj. C. W. Howell, 1879-'81. Reports, '80, 1157, 1164; '81, 1231.

Maj. Stickney, 1881-'83. Reports, '82, 1373; '83, 1106.

Maj. W. H. Heuer, 1887-'—. Report, '87, 1398.

ASSISTANTS.

W. H. Hoffman. Report, '80, 1165.

Lieut. O. T. Crosby. Report, '87, 1398.

Operations.

1881-'82. 22 miles of river below the railroad bridge cleared of obstructions by contract, '82, 1373.

1882-'83. 27½ miles of river cleared and a brush dike 650 feet long built by contract, '83, 1106.

Plans.

Maj. Heuer, 1886, estimated the cost of improvement from Abbeville to Louisiana and Texas Railroad Bridge, by removal of snags, etc., at \$5,000, but does not consider the locality worthy of improvement, '87, 1398.

Projects.

By Maj. Howell, 1879, for the improvement of the river to a low-water depth of 5 feet, from the railroad bridge above Vermillion to its mouth in Vermillion Bay, by the removal of trees, logs, and snags. Estimated cost, \$9,900, '80, 1157, 1165, 1166. The improvement not considered permanent, '80, 1165; '83, 1107; '87, 1398.

Surveys.

Ordered by act of March 3, 1879, '80, 145. Survey made under direction of Maj. Howell, 1879, '80, 1164.

Examination from Abbeville to railroad bridge ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Heuer, '87, 1398.

VINEYARD HAVEN HARBOR, MASS.—REPORT ON CONDITION OF.

[\$25,000 appropriated by act of August 11, 1888.]

Engineers.**CHIEF OF ENGINEERS.**

Reports, '82, 90; '87, 43.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1881. Report, '82, 592.

Maj. W. R. Livermore, 1882-'— Report, '87, 572, 573.

Physical Characteristics.

Description of harbor, '82, 592; '87, 574.

Plans.

By Lieut. Col. Warren, for protection of 5,000 linear feet of bluff by deposit of 40,000 tons of riprap. Estimated cost, \$60,000, '82, 594.

By Maj. Livermore, 1887, for formation of harbor of refuge by breakwater and jetty construction. Estimated cost, \$3,983,936, '87, 579.

Surveys.

Examination and survey ordered by act of March 3, 1881. Made under direction of Lieut. Col. Warren, '82, 594; '87, 572.

MAPS.

'87, 580.

VOLUSIA BAR, FLA.—IMPROVEMENT OF.**Appropriations.**

1880..... \$5,000, '80, 972.

1881..... 5,500, '81, 1137.

1882..... 5,000, '82, 1200.

1884..... 2,000, '84, 1136.

1886..... 7,500, '86, 1137.

Total 25,000

1888..... 500, act of August 11, 1888.

Contracts.

1880. Anderson & Blaisdell, for mattress and riprap construction, \$2.95 per linear foot, '81, 1137.

1881. L. A. Cunningham, for jetty construction, brush mattresses, at \$1 per square yard, and riprap, at \$6 per cubic yard, '82, 1201.

1882. G. A. De Cottes, for jetty construction, mattresses, at 95 cents per square yard; riprap stone, at \$5.95 per cubic yard, '83, 953.

1884. Hopkins & Le Baron, for jetty reconstruction, '85, 2257.

1886. I. A. Bryan, for jetty construction, '87, 1218.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 131; '81, 178; '82, 174; '83, 184; '84, 192; '85, 193; '86, 192; '87, 155.

ENGINEERS IN CHARGE.

Col. Q. A. Gillmore, 1880-'85. Reports, '80, 971; '81, 1135; '82, 1198; '83, 951; '84, 1134.

Capt. W. T. Rossell, 1885-'86. Report, '85, 1254.

Capt. W. M. Black, 1886-'—. Reports, '86, 1135; '87, 1216.

ASSISTANTS.

Lieut. W. L. Fisk. Report, '81, 1137.

Capt. J. C. Post. Report, '82, 1201.

Capt. W. T. Rossell. Report, '83, 953.

A. W. Barber. Report, '85, 1250.

Operations.

1880-'81. 1,950 linear feet of brush and stone jetty built, '81, 1136.

1881-'82. 1,836 linear feet of mattress, bottom course, laid on line of east jetty; west jetty extended 256 feet; 100 piles driven, '82, 1200.

1882-'83. East jetty extended to the bar by addition of 1,623 linear feet of work; 43 guide-piles driven, '83, 952.

1883-'84. No operations for lack of funds, '84, 1134.

1884-'85. Broken piling removed, guide-piling driven, and 75 cubic yards riprap stone placed in east jetty, '85, 1256.

1885-'86. No operations, '86, 1136.

VOLUSIA BAR, FLA.—Continued.**Operations—Continued.**

1886-'87. Jetties raised to low water by brush fascines and stone, and repairs to guide-piling, '87, 1217

Projects.

By Col. Gillmore, for narrowing the existing channel by two converging brush and stone jetties starting from the shore and extending to the 6-foot curve in the lake, and with such width between the ends as will maintain a channel depth of 6 feet at low water, the channel to be further defined and guarded by rows of fender-piles, and deepened by dredging, if necessary. Estimated cost, \$15,000, '80, 972. Revised estimate, \$25,000, '86, 1135; '87, 1217.

Surveys.**Maps.**

'81, 1136; '83, 952.

WABASH RIVER, IND.—IMPROVEMENT OF.

(Continued from Vol. I, p. 568.)

Appropriations.

1828-'79.....	\$321,500	
1880.....	25,000, '80, 1842.	
1881. { Below Vincennes.	25,000, '81, 2000.	
{ Above Vincennes.	25,000, '81, 2002.	
1882. { Below Vincennes.	40,000, '82, 1973.	
{ Above Vincennes.	30,000, '82, 1974.	
1884. { Below Vincennes.	30,000, '85, 1640.	
{ Above Vincennes.	10,000, '85, 1641.	
1886. Below Vincennes...	*69,000, '86, 278.	
Total.....	575,500	
1888. { Below Vincennes.	60,000	} act of August 11, 1888.
{ Above Vincennes.	5,000	

Commerce.

Reduction of railroad freights through improvement of navigation, '82, 1975.

Contracts.

1884. Carmody & Maple, for lock stone, '85, 1639.

Encroachments.

Obstruction of river at Terre Haute by highway bridge, '83, 1584; '85, 86.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 197; '81, 266; '82, 260; '83, 268; '84, 267; '85, 255, 257; '86, 277, '87, 246.

ENGINEERS IN CHARGE.

Maj. J. A. Smith, 1877-'84. Reports, '80, 1837; '81, 1995; '82, 1969; '83, 1577; '84, 1757.

Capt. J. C. Post, 1884; '85, 1638.

Maj. A. M. Miller, 1884-'86. Report, '85, 1638, 1649.

Maj. A. Stickney, 1886-'— . Reports, '86, 1582; '87, 1864.

ASSISTANTS.

A. L. Duvall. Report, '85, 1650.

O. L. Petitdidier. Report, '87, 1865, 1869.

Operations.

1879-'80. Snag-boat built under contract; 136 snags removed from river channel; dam completed across New Harmony Cut-off; pile, brush, and stone bank protections at Grayville completed, 250 feet of dike at Grand Chain raised to grade; bank protection at New Harmony; dam across cut-off at Little Chain and at Winkler's Bar built; removal of coffer-dam at Warwick's Ripple commenced, '80, 1838.

1880-'81. 202 snags and 103 trees removed; 987 cubic yards rock removed at Warwick's Ripple; 830 linear feet of dike built and 160 cubic yards of rock removed at Grand Chain; 750 linear feet of pile and brush wing-dams built at Winkler's Bar; 550 linear feet of bank protection built at McIntyre's Bar; repairs to New Harmony Dam and stone protection at same, '81, 1996.

*\$6,000 to be expended at Grayville, '87, 1864.

WABASH RIVER, IND.—Continued.**Operations—Continued.**

1881-'82. Below Vincennes: 825 linear feet of crib-work completed at Little Chain; wing-dam at McIntyre's Bar completed and that at Winkler's Bar extended 900 feet; shore protection of New Harmony Dam extended; 267 snags and 70 piles removed from the river; repairs to plant. Above Vincennes: 210 snags and 51 trees removed from the channel, '82, 1970.

1882-'83. Below Vincennes: 764 cubic yards of stone removed from channel through reef at Little Chain, extensive repairs to brush and stone dam at same; timber dike at Grand Chain repaired; repairs to Turkey Island and New Harmony dams; 134 snags removed between Little Chain and the mouth. Above Vincennes: 262 snags removed from channel between Vincennes and Terre Haute; crib, brush, and stone dam constructed at Eight-mile Island, '83, 1578-1583.

1883-'84. Below Vincennes: 8,690 cubic yards stone removed from cut and placed in dike at Little Chain; 504 cubic yards stone quarried and 369 linear feet crib-work built in same; 400 linear feet of wing-dam built; repairs to New Harmony Dam. Above Vincennes: 610 snags and 39 piles removed; work continued on dam at Horseshoe Island, '84, 1758-1762.

1884-'85. Below Vincennes: No operations, '85, 1640. Above Vincennes: 377 snags removed from the river; dam at Horseshoe Island completed, '85, 1641.

1885-'86. Below Vincennes: No operations, '86, 1582. Above Vincennes: No operations, '86, 1585.

1886-'87. Below Vincennes: Delivery of stone for lock and dam at Grand Rapids; removing old lock walls and preparing sight for new work; construction of levee at Grayville, '87, 1864, 1867. Above Vincennes: Clearing out old dam cut-off at Horseshoe Bend, '87, 1869.

Projects.

The project of 1872 proposed the improvement of the river from its mouth to Vincennes by construction of lock and dam at Grand Rapids; the construction of wing-dams at various points, and removal of rocky ledges, snags, logs, and similar obstructions, so as to give a navigable channel of 34 feet at extreme low water; also, for improvement of river from Vincennes to Terre Haute by closing out-offs, concentration of current by training-walls and wing-dams and removal of snags and rock obstructions, '72, 463, 472; '73, 59, 511; '74, i, 66, 486; '80, 1841.

From 1871 to 1886, inclusive, \$573,000 was appropriated.

In 1887 it was estimated that \$250,600 would be required to complete the project for that part of the river below Vincennes and \$20,000 for the river above Vincennes, '87, 1864, 1869.

Surveys.

Detailed survey of river from Bone Bank to its mouth, a distance of 9 miles, made 1880, '80, 1840.

Survey extended from head of Grand Chain to Little Chain, '81, 1998.

Above Vincennes, '82, 1973; '83, 1583; '84, 1759.

From Logansport to Delhi, '85, 1649.

WACCAMAW AND CAPE FEAR RIVERS, N. C.—WATER CONNECTION BETWEEN.

(See CAPE FEAR AND WACCAMAW RIVERS, N. C.)

WACCAMAW RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 570.)

Appropriations.

1880.....	\$15,000, '80, 848.
1881.....	10,000, '81, 1032.
1882.....	4,400, '82, 1109.
1884.....	6,000, '84, 1048.
1886.....	15,000, '86, 1023.

Total..... 50,400

WACCAMAW RIVER, N. C.—Continued.**Commerce.**

Increase in commerce consequent upon improvement of river, '86, 1022.

Contracts.

1881. T. W. Daggett, for furnishing steam-hoisting and pile-driving machinery, at \$25 per day, '81, 1031.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 124, 125; '81, 166; '82, 162; '83, 170; '84, 175, 177; '85, 173; '86, 170; '87, 134.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'81. Report, '80, 848.

Capt. J. Mercur, 1881-'84. Reports, '81, 1030; '82, 1108; '83, 868.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1048, 1056.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1105; '86, 1022; '87, 1065.

ASSISTANTS.

C. W. Forster. Report, '80, 850.

H. Heth. Reports, '81, 1031; '82, 1109; '83, 869; '84, 1048.

R. Whitford. Reports, '85, 1106; '86, 1024; '87, 1068.

Operations.

History of work, '86, 1024.

1880-'81. Brush and pile jetties for contracting the channel built at Needle's Eye Shoal and Oat Bed Shoal, '81, 1031, 1032.

1881-'82. Removal of snags, logs, and similar obstructions continued and driving of piles completed on both shoals, securing 12 feet depth throughout, '82, 1108, 1109.

1882-'83. Banks trimmed of overhanging trees between Conwayborough and Georgetown, '83, 869.

1883-'84. Trees, logs, and snags removed from the river between Conwayborough and Needle's Eye Shoal, '84, 1048.

1884-'85. 932 snags, stumps, and trees, 1 flat-boat and 1 schooner removed from bed of river; 1,265 trees and 1,455 linear feet of brush removed from banks, clearing 66 miles of river, '85, 1105.

1885-'86. No operations for lack of funds, '86, 1023.

1886-'87. Obstructions removed from 34 miles of river, extending the improvement to about 96 miles above Georgetown, '87, 1067, 1068.

Physical Characteristics.

Description of the river, '80, 849; '87, 1066.

Projects.

By Capt. Phillips, 1880, for improvement of Waccamaw River by formation of a channel 12 feet deep at all stages of water, with 80 feet bottom width, from the mouth of the river 66 miles upward to Conwayborough; also a channel 178 miles further to Lake Waccamaw. Estimated cost, \$29,370, '80, 848. Estimate revised in 1885 and 1886 to \$138,400, '85, 1105; '86, 1022.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 848.

Between Conwayborough and Waccamaw Lake ordered by act of August 2, 1882. Reported by Capt. Mercur as unworthy of improvement, '84, 1056.

WACHITA RIVER, ARK. AND LA. (See OUACHITA RIVER, ARK. AND LA.)

WACISSA AND AUCILLA RIVERS, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 141; '81, 189; '82, 185; '85, 214; '86, 212.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1880. Reports, '82, 1302; '86, 1220.

ASSISTANTS.

P. Robinson. Report, '82, 1302.

R. Rauchenstein. Report, '86, 1221,

WACISSA AND AUCILLA RIVERS, FLA.—Continued.**Plans.**

By Maj. Damrell, 1881, for improvement of the Aucilla River by removal of 12 natural bridges over same. Estimated cost, \$5,000, '82, 1303.

By Maj. Damrell, 1884, for improvement of the Wacissa River, giving a minimum width of 30 feet and 24 feet depth at low water by removal of snags, trees, and brush, excavation of rocks and earth at the shoals, and dam construction. Estimated cost, \$17,000, '86, 1220, 1221.

Surveys.

Ordered by act of June 14, 1880. Made, 1881, under direction of Capt. Damrell, '82, 1302.

WADDINGTON HARBOR, N. Y.—IMPROVEMENT OF.

(Continued from Vol. I, p. 570.)

Appropriations.

1873-'79	\$30,000
1880	3,000, '80, 2226.
1881	2,500, '81, 2453.

Contracts.

1880. C. Daly, for dredging, with and without blasting, at \$5 and 50 cents per cubic yard, respectively, '80, 2227.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 233; '81, 319; '82, 313; '83, 323; '87, 317.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1876-'83. Reports, '80, 2225; '81, 2452; '82, 2462.

Lieut. Col. H. M. Robert, 1883-'85. Report, '83, 1955.

Maj. M. B. Adams, 1885—'. Report, '87, 2414.

ASSISTANTS.

F. T. Hampton. Report, '82, 2464.

J. C. Churchill. Report, '87, 2415.

Operations.

1879-'80. 2,200 cubic yards material dredged from the channel, '80, 2225.

1880-'81. No operations, '81, 2453.

1881-'82. 650 cubic yards rock blasted and removed, '82, 2466.

1882-'83. No operations, '83, 1955.

Projects.

The original project by Maj. Wilson was for opening a channel through the bar at the head of Little River and to carry it to the docks by dredging, at an estimated cost of \$17,000, '73, 390. '74, i, 272. Also for cleaning the channel by dredging and rock excavation, at an estimated cost of \$5,000, '75, i, 60, 350. These estimates were increased in 1880 by Maj. McFarland to \$22,000 for completion on account of the character of rock developed, '80, 2226.

Maj. Adams, 1886, reports a general improvement of the harbor unadvisable in view of the requirements of commerce, '87, 2415.

Surveys.

Examination ordered by act of August 5, 1886. Made, 1886, under direction of Maj. Adams, '87, 2414.

MAPS.

'81, 2452; '82, 2468.

WAKULLA RIVER, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '87, 162.

ENGINEER IN CHARGE.

Lieut. W. M. Black. Report, '87, 1260.

WAKULLA RIVER, FLA.—Continued.**Plans.**

In 1887 Lieut Black considered that the present facilities for navigation were sufficient for the demands of commerce, '87, 161.

Surveys.

Examination ordered by act of August 5, 1886. Made under direction of Lieut. Black, '87, 1260.

WANS-WAN-GOISING BAY, MINN. (See GRAND PORTAGE AND WANS-WAN-GOISING BAYS, MINN.)**WAPPOO CUT, S. C.—IMPROVEMENT OF.****Appropriations.**

1881.....	\$10,000, '81, 1070.
1882.....	10,000, '82, 1142.
1884.....	3,000, '84, 1092.
1886.....	5,000, '86, 1079.
Total.....	28,000
1888.....	5,000, act of August 11, 1888.

Contracts.

1882. Charleston Dredging Company, for dredging, at 16, 18, and 20 cents per cubic yard, according to distance to which material is removed, '83, 886.

1885. Ross & Sanford, for dredging, at 17, 19, and 21 cents per cubic yard, according to distance to which material is to be removed, '86, 1079.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 132; '81, 171; '82, 166; '83, 173; '84, 180; '85, 179; '86, 178; '87, 141.

ENGINEER IN CHARGE.

Col. Q. A. Gillmore, 1880—. Reports, '81, 1069, 1070; '82, 1140; '83, 884; '84, 1089; '85, 1186; '86, 1077; '87, 1138.

ASSISTANTS.

Capt. B. D. Green. Report, '81, 1070.

Capt. J. C. Post. Report, '81, 1072.

Lieut. T. N. Bailey. Reports, '83, 886; '84, 1092.

Lieut. F. V. Abbot. Reports, '85, 1188; '86, 1080.

Operations.

1882-'83. 91,210 cubic yards material dredged from channel in Elliot's Cut, '83, 885.

1883-'84. 10,746 cubic yards material dredged from Wappoo and Elliot's Cut; 44 snags removed from various points in channel, '84, 1090.

1884-'87. No operations, '85, 1186; '86, 1077; '87, 1139.

Projects.

By Col. Gillmore, 1880, for improvement of Wappoo Cut by excavation of a channel 90 feet wide and 6 feet deep at low water, from the deep water of the Ashley to that of the Stono river; also for 1,600 linear feet of jetty construction at either end of proposed channel and 700 linear feet of bulkhead to close tidal branch. Estimated cost, \$34,155, '81, 1073. Increased \$3,000 in 1885, '85, 1187; '87, 1138, 1139.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Gillmore, '81, 1070.

MAPS.

'81, 1072; '84, 1090.

WAREHAM HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 571.)

Appropriations.

1872-'79.....	\$40,000
1881.....	10,000, '81, 550.

WAREHAM HARBOR, MASS.—Continued.**Appropriations—Continued.**

1882.....	\$5,000, '82, 554.
1884.....	10,000, '84, 602.
1886.....	15,000, '86, 594.

Total	80,000
1888.....	4,000, act of August 11, 1888.

Contracts.

1881. J. McDermott, for dredging, at 24½ cents per cubic yard, '81, 549.
 1884. Atlantic Dredging Company, for dredging, at 16½ cents per cubic yard, '85, 586.
 1886. F. Pidgeon, for dredging, at 14 cents per cubic yard, '87, 543.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 73, 76; '81, 79, 89; '82, 80; '83, 76; '84, 82; '85, 70; '86, 70; '87, 34.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1880-'82. Reports, '80, 371; '81, 549, 550; '82, 553.
 Maj. J. W. Barlow, 1882. '83, 475.
 Maj. F. Harwood, 1883. '83, 475.
 Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 475; '84, 600; '85, 585; '86, 593.
 Maj. W. R. Livermore, 1887-'—. Report, '87, 540.

ASSISTANT.

J. P. Cotton. Report, '81, 550.

Operations.

1881-'82. 28,383 cubic yards material dredged from the channel, '82, 553.
 1882-'83. 1,100 linear feet of brush and stone wall built across west end of beach;
 1,864 linear feet of catch-sand fence built, '83, 475.
 1883-'84. 1,143 linear feet of brush and stone wall built and repairs made to wall already built, '84, 602.
 1884-'85. 3,235 cubic yards material dredged from the channel, '85, 586.
 1885-'86. 43,444 cubic yards material dredged from the channel, '86, 594.
 1886-'87. 25,448 cubic yards dredged from the channel, '87, 541.

Physical Characteristics.

General description of harbor, '81, 551.

Projects.

The project of 1871 proposed the formation, by dredging, of a channel 9 feet deep at low water across Quahaug Bar, the widening of the channel below the Franconia Iron-Works, and the removal of the ledge from the Weweeanlight River at its junction with Wareham River. Estimated cost, \$45,000, '72, 953.
 By Lieut. Col. Warren, 1880, for improvement of the harbor by widening the channel through the "upper bar" to 350 feet, with a depth of 10 feet, widening and straightening the channel thence to Barney Point to 250 feet width and 10 feet depth; also widening channel at Quahaug Bar and construction of brush and stone barriers for the preservation of Long Beach. Estimated cost, \$44,050, '81, 553, 554; '87, 541. Increased, 1887, by \$12,186, '87, 542.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Warren, '81, 550.

MAPS.

'84, 602; '85, 586.

WARREN RIVER, R. I.—SURVEY AND IMPROVEMENT OF.**Appropriation.**

1886.....	\$5,000, '86, 605.
-----------	--------------------

Commerce.

Statistics, '85, 626.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '85, 80; '86, 75; '87, 36.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Elliot, 1884-'87. Reports, '85, 625, 627; '86, 605.
 Maj. W. R. Livermore, 1887-'—. Report, '87, 547.

ASSISTANT.

G. Alexander. Report, '85, 629.

WARREN RIVER, R. I.—Continued.**Physical Characteristics.**

Description, '86, 625.

Projects.

By Lieut. Col. Elliot, 1885, for improvement of Warren River by removal of Bushworth Rock and boulders in narrow portion of channel below Little Island. Estimated cost, \$5,000, '85, 628; '87, 547.

Surveys.

Ordered by act of July 5, 1834. Made, 1885, under direction of Lieut. Col. Elliot, '85, 627.

MAPS.

'85, 630.

WARRIOR RIVER, ALA. (See BLACK WARRIOR RIVER, ALA.)**WASHINGTON AND GEORGETOWN HARBORS, D. C. (See POTOMAC RIVER IN VICINITY OF WASHINGTON, D. C.)****WASHINGTON AQUEDUCT, D. C.****Appropriations.**

1882..... \$20,000, '83, 2080.

1883..... 20,000, '83, 2080.

Appropriations to June 30, 1881, '80, 2363.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 243; '81, 334; '82, 324; '83, 338; '84, 342; '85, 372; '86, 365; '87, 333.

ENGINEERS IN CHARGE.

Lieut. Col. T. L. Casey, 1877-'83. Reports, '80, 2344, 2358; '81, 2703; '82, 2729.

Maj. G. J. Lydecker, 1883-'— . Reports, '83, 2077; '84, 2453; '85, 2453; '86, 2013; '87, 2527.

ASSISTANTS.

T. B. Saino. Report, '80, 2350.

Capt. T. W. Symonds. Report, '85, 2456.

Operations.

1879-'80. Macadamized roadway extended 576 feet; extensive repairs to gate-house roofs; timber roadway constructed over Rock Creek Bridge; College Pond and Rock Creek bridges repainted, and 700 linear feet of dam at head of Conn's Island rebuilt, '80, 2344-2347.

1880-'81. Gate-house walls plastered with Portland cement mortar; timber bridge built over waste channel of receiving reservoir; connecting conduit masonry raised; exterior of Georgetown high-service reservoir plastered, '81, 2703, 2705.

1881-'82. Repairs to Great Falls Dam; 1,470 linear feet of temporary dam built; extensive repairs and additions to receiving, distributing, and high-service reservoirs, '82, 2730.

1882-'83. Repairs and reconstruction to temporary dams at head of Conn's Island; extensive repairs to Aqueduct road, '83, 2078.

1883-'84. Addition made to Aqueduct office, establishment of telephonic communication between central office and the reservoirs, and extension of macadamized roadway surface, '84, 2300.

1884-'85. Work continued on Aqueduct road and repairs to Conn's Island Dam, '85, 2453.

1885-'86. Repairs to break in 3-foot main; masonry discharging weir built through bank of Chesapeake and Ohio Canal, '86, 2014.

1886-'87. General repairs necessary for maintenance of aqueduct and works relating thereto, '87, 2528.

Physical Characteristics.

Outflow of water from the reservoir measured at specific intervals, '80, 2349.

WASHINGTON AQUEDUCT, D. C.—Continued.**Surveys.****MAPS.**

Great Falls '85, 2463.

Country adjacent to receiving reservoir, '85, 2462.

Improvement of receiving reservoir, '85, 2462.

WASHINGTON, D. C.—INCREASING WATER SUPPLY OF.**Appropriations.**

1882.....	\$1,485,279.30, '83, 339.
1884.....	87,500.00, '86, 2060.
1885.....	87,500.00, '86, 2060.
1886.....	5,000.00, '86, 2060.

Total..... 1,665,279.30

Engineers.**BOARD OF ENGINEERS.**

Convened at Washington July 14, 1885, by S. O. No. 107, to report upon water supply, '85, 2497. (Col. Casey, Lieut. Col. Craighill, and Maj. Lydecker.)

Convened at New York August 24, 1886, by S. O. No. 111, C. of E., to report upon present condition and future methods of procedure in construction of the terminal at Washington, '87, 2546. (Col. Duane and Lieut. Cols. Abbot, Comstock, and McFarland.)

CHIEF OF ENGINEERS.

Reports, '83, 333; '84, 343; '85, 373; '86, 366; '87, 334.

ENGINEER IN CHARGE.

Maj. G. J. Lydecker, 1882.—Reports, '83, 2080; '84, 2301; '85, 2469; '86, 2021, 2043; '87, 2535-2549.

ASSISTANT.

Capt. T. W. Symonds. Reports, '85, 2478; '86, 2021.

Legislation.

Act increasing water supply of Washington City, '83, 2090.

Operations.

1883-'84. Dam at Great Falls under construction; tunnel extended 536 feet; work upon new reservoir commenced, '84, 2302, 2304, 2306.

1884-'85. Tunnel excavation completed for a total distance of 13,500 feet; three-fifths of reservoir excavation completed; work on dam continued; work of making main connection completed, '85, 2469, 2470, 2473, 2475.

1885-'86. Work on dam nearly completed; excavations in the general headings of the tunnel aggregate 13,500 linear feet; work continued upon reservoir, '86, 2041, 2045. Work on Great Falls Dam, aqueduct extension, reservoir, tunnel, and main connections continued, '87, 2536-2541.

Physical Characteristics.

Description of water supply, '86, 2029.

Projects.

By Maj. Lydecker, 1883, for increasing the water supply of Washington by extension of Washington Aqueduct from distributing reservoir near Drovers' Rest to sight of new reservoir near Howard University by a tunnel 20,715 feet long; extension of dam at Great Falls of Potomac across Conn's Island and Virginia Channel; construction of new distributing reservoir in valley east of Howard University, and laying mains from reservoir to center of distribution, '84, 2301.

Surveys.**MAPS.**

'85, 2463, 2496.

Of tunnel, '86, 2050; '87, 2538.

WASSAW RIVER AND FERNANDINA, FLA.—INSIDE PASSAGE BETWEEN.

(See SAINT JOHN'S RIVER.)

WATER COMMUNICATION BETWEEN DELAWARE AND CHESAPEAKE BAYS. (See DELAWARE AND CHESAPEAKE BAYS.)

WATER COMMUNICATION FROM NORFOLK HARBOR TO ATLANTIC OCEAN, SOUTH OF HATTERAS—SURVEY FOR.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 125.

ENGINEER IN CHARGE.

Capt. C. B. Phillips. Report, '80, 851.

ASSISTANTS.

F. W. Frost. Report, '80, 862.

J. B. Shinn. Report, '80, 876.

Physical Characteristics.

Description of Albemarle, Pamlico, and Core sounds, North Carolina, and various outlets therefrom to the ocean south of Hatteras, '80, 857.

Plans.

By Capt. Phillips, 1880, for improvement of the Albemarle and Chesapeake Canal by reconstruction and by excavation of Virginia and North Carolina cuts. Estimated cost, \$509,701, '80, 869.

For improvement of the Dismal Swamp Canal two estimates of \$1,483,646 and \$1,098,379, respectively, '80, 875.

For a channel 80 feet wide and 9 feet deep from Norfolk Harbor to Albemarle Sound, via Dismal Swamp Canal, total length, 73 miles. Estimated cost, \$1,492,622, '80, 883.

For a tide-water connection between the Neuse and Cape Fear rivers, with a channel width of 80 feet, depth 9 feet, and 4 guard-locks; distance, 102 miles. Estimated cost, \$5,694,734, '80, 896.

Surveys.

Ordered by act of June 18, 1878. Made, 1880, under direction of Capt. Phillips, '80 851.

MAPS.

'80, 896.

WATER COMMUNICATION BETWEEN SAINT JOHN'S RIVER AND CHARLOTTE HARBOR, FLA. (See SAINT JOHN'S RIVER AND CHARLOTTE HARBOR, FLA.)

WATER COURSES IN LOUISIANA—REMARKS ON IMPROVEMENT OF.

Engineers.

ENGINEER IN CHARGE.

Maj. C. W. Howell. Report, '80, 1189.

ASSISTANT.

H. C. Collins. Report, '80, 1190.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Howell, '80, 1189.

WATEREE RIVER, S. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 574.)

Appropriations.

1881.....	\$8,000, '81, 1034.
1882.....	15,000, '82, 1112.
1884.....	5,000, '84, 1052.
1886.....	7,500, '86, 1055.

Total	35,500
1888.....	12,000, act of August 11, 1888.

WATEREE RIVER, S. C.—Continued.**Commerce.**

Justification of improvement, '87, 1089.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 125; '81, 167; '82, 163; '83, 170; '84, 176; '85, 176; '86, 174; '87, 137.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1880-'81. Report, '80, 914.

Capt. J. Mercur, 1881-'84. Reports, '81, 1033, 1034; '82, 1111; '83, 871.

Capt. F. A. Hinman, 1884-'85. Report, '84, 1051.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1123; '86, 1053; '87, 1069.

ASSISTANTS.

J. M. Wolbrect. Report, '80, 915.

J. P. Darling. Report, '81, 1035.

H. Heth. Report, '82, 1112.

R. Whitford. Reports, '85, 1124; '87, 1090.

Operations.

1881-'82. Removal of snags and trees from the channel and banks commenced, '82, 1112.

1882-'83. Removal of snags and obstructions continued, '83, 871.

1883-'84. 1,333 logs and snags taken from bed of river and 2,725 trees removed from the banks, '84, 1051.

1884-'85. 360 logs and snags taken from bed of river and 385 trees out from the banks, '85, 1123.

1885-'86. No operations, '86, 1055.

1886-'87. 205 logs and snags removed from river, 5 piles removed from old bridge at Camden, and banks cleared of leaning trees, '87, 1090, 1091.

Projects.

By Capt. Phillips, 1880, to secure a 4-foot navigation between the mouth and Camden, a distance of 68 miles, by removal of snags, stumps, and similar obstructions, and removal of fallen and leaning trees from the banks. Estimated cost, \$29,552, '80, 915, 916.

Increased in 1881, 1885, and 1887 to \$60,000, on account of inadequate appropriations, '81, 1034; '85, 1124; '87, 1089.

Total amount appropriated for 1881 to 1886, inclusive, \$35,500. Amount estimated to complete project, \$24,500, '87, 1091.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Capt. Phillips, '80, 914.

WATER-GAUGES ON THE MISSISSIPPI RIVER. (See MISSISSIPPI RIVER, WATER-GAUGES ON.)**WATER PASSAGE, DEAL'S ISLAND, MD. (See DEAL'S ISLAND, MD.)****WATER-WAY BETWEEN JAMAICA BAY AND CORNELL'S LANDING, N. Y. (SEE JAMAICA BAY AND CORNELL'S LANDING.)****WAUKEGAN HARBOR, ILL.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 574.)

Appropriations.

1852-'73	\$15,000
1880	15,000, '80, 1942.
1881	15,000, '81, 2130.

WAUKEGAN HARBOR, ILL.—Continued.**Appropriations—Continued.**

1882.....	\$20,000, '82, 2163.
1884.....	20,000, '84, 1871.
1886.....	20,000, '86, 1686.

Total.....	105,000
1888.....	25,000, act of August 11, 1888.

Contracts.

Knapp & Gillen, for pier construction, '81, 2131.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 208, 210; '81, 282; '82, 277; '83, 286; '84, 286; '85, 309; '86, 303; '87, 269.

ENGINEERS IN CHARGE.

Lieut. Col. D. C. Houston, 1872-'84. Reports, '80, 1940, 1942, 1946; '81, 2129; '82, 2163; '83, 1710.

Capt. W. L. Marshall, 1884-'—. Reports, '84, 1871; '85, 2023; '86, 1686; '87, 2074.

ASSISTANT.

W. H. Hearing. Reports, '80, 1944; '82, 2164; '83, 1711; '84, 1871; '85, 2024; '87, 2075.

Operations.

History of the work, '80, 1940.

1881-'82. 260 linear feet pile-pier built and breach in same repaired, '82, 2164.

1882-'83. 224 linear feet pile-pier built, '83, 1712.

1883-'84. 226 linear feet pile-pier built, '84, 1871.

1884-'85. 298 linear feet pile-pier built, '85, 2023.

1885-'86. Pile pier extended 32 linear feet, '86, 1686.

1886-'87. 209 linear feet of north pier and 96 feet of south pier built, '87, 2074, 2076.

Injury to work by gale, '87, 2076.

Projects.

In 1855, under the appropriation of \$15,000 of 1852, one crib was placed in line of proposed breakwater, which was subsequently destroyed, '73, 247; '80, 1942.

By Lieut. Col. Houston, 1879, for formation of a harbor of refuge at Waukegan by 2,590 linear feet of pile-pier construction, inclosing a basin of 16 acres area and a dock front of 1,260 feet, the basin to be dredged to a depth of 12 feet, with the ultimate formation of an inner basin. Estimated cost, \$110,000, '80, 1943, 1946. Increased \$50,000 in 1883, '83, 1711; and \$20,000 in 1886, '86, 1686. From 1880 to 1886, inclusive, \$90,000 was appropriated, when it was estimated that \$71,000 would be required to complete project, '87, 2075.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Houston, '80, 1942.

MAPS.

'83, 1710; '84, 1871; '85, 2023.

WEKIVA RIVER, FLA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 199.

ENGINEER IN CHARGE.

Capt. W. T. Russell. Report, '85, 1281.

ASSISTANT.

H. C. Miller. Report, '85, 1282.

Physical Characteristics.

Description of, '85, 1282.

Plans.

Capt. Russell, 1884, states that the prospective commerce would warrant improvement, '85, 1281.

Surveys.

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Capt. Russell, '85, 1281.

WELLFLEET HARBOR, MASS.

Examination ordered by act of August 5, 1886, '87, 31. [\$7,000 appropriated by act of August 11, 1888.]

WESTERN RIVERS—REMOVING SNAGS AND OBSTRUCTIONS FROM.

(See MISSISSIPPI RIVER, MISSOURI RIVER, AND ARKANSAS RIVER.)

WEST PEARL RIVER, LA.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 146; '81, 197; '83, 212.

ENGINEER IN CHARGE.

Maj. A. Stickney, 1880. Report, '83, 1130.

ASSISTANT.

H. C. Collina. Report, '83, 1131.

Physical Characteristics.

Description, '83, 1131.

Plans.

Maj. Stickney, in 1883, did not consider the river worthy of improvement nor the same a public necessity, '83, 1130.

Surveys.

Examination ordered by act of June 14, 1880. Made, 1883, under direction of Maj. Stickney, '83, 1130.

WESTPORT HARBOR, MASS.—SURVEY AND IMPROVEMENT OF.**Appropriation.**

1886..... \$1,000, '86, 592.

Contracts.

1887. W. H. Motthorp & Co., for construction of jetties, '87, 544.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '84, 99; '86, 70; '87, 35.

ENGINEERS IN CHARGE.

Maj. W. McFarland, 1892. Report, '84, 675.

Maj. J. W. Barlow, 1884. Report, '84, 673.

Lieut. Col. G. H. Elliot, 1886-'87. Report, '86, 592.

Maj. W. B. Livermore, 1887-'— Report, '87, 543.

ASSISTANT.

H. N. Babcock. Report, '84, 676.

Operations.

1886-'87. Construction of jetties commenced, '87, 543.

Physical Characteristics.

Description of harbor, '84, 674.

Plans.

By Lieut. Col. McFarland, 1883, for improvement of the harbor by increasing the depth of channel between Saugatuck and Westport to 4 foot, low water, and width to 100 feet. Estimated cost, \$36,000, '84, 675.

Projects.

By Maj. Warren, 1878, for the protection of Horse Neck Point from erosion by the construction of jetties at that point. Estimated cost, \$1,000, '86, 592; '87, 543.

Surveys.

Ordered by act of August 2, 1882. Made, 1883, under direction of Maj. McFarland, '84, 675.

WETIPKIN (Wehpquin) CREEK, MD.—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '84, 151.

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '84, 956.

Plans.

Capt. Turtle, in 1882, did not consider the improvement a public necessity, '84, 956.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Lieut. Col. Craighill, '84, 956.

WHIPPLE CREEK, ILL. (See QUINCY HARBOR, ILL.)**WHITEHALL HARBOR, N. Y. (See LAKE CHAMPLAIN.)****WHITE OAK RIVER, N. C.—SURVEY OF.**

(See also BEAUFORT HARBOR AND NEW RIVER.)

Engineers.

CHIEF OF ENGINEERS.

Reports, '81, 168; '82, 163; '84, 177.

ENGINEERS IN CHARGE.

Capt. J. Mercur, 1881-'84. Report, '82, 1113; '84, 1055.

ASSISTANT.

J. P. Darling. Reports, '82, 1113; '84, 1055.

Physical Characteristics.

Description of the river, '82, 1113.

Plans.

In 1882 and 1884 Capt. Mercur did not consider any improvement of the river advisable, '82, 1113; '84, 1055.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1882, under direction of Capt. J. Mercur, '82, 1113.

Examination of White Oak River to Smith's Mills ordered by act of August 2, 1882. Made, 1883, under direction of Capt. J. Mercur, '84, 1055.

WHITE RIVER, ARK.—IMPROVEMENT OF.

(See also WHITE AND SAINT FRANCIS RIVERS.)

(Continued from Vol. I, p. 580.)

Appropriations.

1874-79.....	\$70,000
1880. { Between Jacksonport and Buffalo Shoals..	5,000, '80, 1313.
{ Above Buffalo Shoals.....	20,000, '80, 1314.
1881. Between Jacksonport and Buffalo Shoals...	8,000, '81, 1512.
1882. { Between Jacksonport and Buffalo Shoals..	6,000, '82, 1580.
{ Above Buffalo Shoals.....	4,000, '82, 1581.
1884. White River, Ark.....	35,000, '85, 1589.
1886. White River, Ark.....	18,000, '86, 1380.
Total.....	166,000
1888.....	25,000, act of August 11, 1888.

WHITE RIVER, ARK.—Continued.**Commerce.**

Commercial statistics, '80, 1312; '85, 1592; '86, 1385.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 153, 154; '81, 216; '82, 214; '83, 221; '84, 230; '85, 248; '86, 240; '87, 207.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyard, 1879-'81. Reports, '80, 1312, 1314; '81, 1429, 1431.

Capt. T. H. Handbury, 1881-'84. Reports, '81, 1511, 1512; '82, 1578, 1580; '83, 1169, 1170; '84, 1409.

Maj. M. B. Adams, 1884. Report, '84, 1401, 1402.

Capt. H. S. Taber, 1884-'—. Reports, '85, 1586, 1591, 1592; '86, 1378, 1381; '87, 1534.

ASSISTANT.

J. D. McKown. Reports, '80, 1313; '81, 1430, 1432; '82, 1581.

Operations.

1879-'80. Rock removed and 2 wing-dams built at Nellie's Apron Shoals, '80, 1312. 1880-'81. 565 linear feet of wing-dam built at Samu's Shoals, 200 feet at Arnold's Shoal, and 200 feet at Maguire's Shoal; 161 logs, snags, and trees removed from river between Jacksonport and Buffalo Shoals, '81, 1429, 1430.

1881-'82. 1,450 linear feet of wing-dams built at Maguire's and Saffold's shoals, and 963 snags, logs, and trees removed between Jacksonport and Buffalo Shoals, '82, 1578, 1579. 1,020 linear feet wing-dams built in river above Buffalo Shoals at Crooked Creek, Red Bud, and Summers' shoals, '82, 1581.

1882-'83. 1,642 snags and trees removed and 294 linear feet of wing-dams built at Bell's Point; no operations above Buffalo Shoals, '83, 1169, 1170.

1883-'84. No operations, '84, 1401, 1402.

1884-'85. 1,621 snags and trees removed between Jacksonport and Buffalo Shoals; bowlders removed at Cackling Pullet and Betsy Gill shoals; solid rock at Porter Hodge Shoal; wing-dams built at Wyatt's and O'Neal's shoals, '85, 1587, 1590, 1593.

1885-'86. Repair of dams at Buffalo Shoals and removal of obstructions between Calico Rock and Batesville, '86, 1379, 1380, 1382.

1886-'87. 166 snags and 6 drift piles and 2,115 trees removed between Newport and the mouth of the river, '87, 1535, 1536.

Plans.

Capt. Handbury, 1893, reports that improvement of the White River at the Memphis and Little Rock Railroad Bridge is not necessary or advisable, '84, 1410.

Projects.

A project for the improvement of the river between Jacksonport and Buffalo Shoals, made in 1871-'72, proposed the removal of snags, logs, and rocks, and the improvement of shoals by the construction of wing-dams, '71, 370; '72, 376; '80, 1314; '85, 1592.

The improvement of the river at Buffalo Shoals was proposed to be accomplished by removal of bowlders and the construction of 7 spur-dikes, '78, 661.

From 1874 to 1879, inclusive, \$70,000 was appropriated for the improvement of the river above Jacksonport, '74, i, 63; '76, i, 80; '79, 115.

In 1887 it was estimated that, pending plans and estimates for the permanent improvement of the river, a yearly appropriation of \$8,000 for the removal of snags would be required for one or two years, '87, 308, 1530.

Surveys.

Examination of White River from Forsythe to Buffalo Shoals, made under direction of Maj. Benyard, 1880, '81, 1432.

Examination and survey of the White River at the Memphis and Little Rock Railroad Bridge, near Devall's Bluff, made 1882-'83, under direction of Capt. Handbury, '84, 1409.

WHITE AND SAINT FRANCIS RIVERS, ARK.—SNAGGING OPERATIONS ON.

(Continued from Vol. I, p. 580.)

Appropriations.

1833-'79 \$113,500
1880..... 12,000, '80, 1311.

WHITE AND SAINT FRANCIS RIVERS, ARK.—Continued.**Appropriations—Continued.**

1881.....	\$8,000, '81, 1511.
1882.....	12,000, '82, 1575.

Total..... 145,500

Appropriations prior to 1880, '80, 1311.

Commerce.

Statistics, '83, 1167.

Engineers.**CHIEF OF ENGINEERS.**

Reports '80, 153; '81, 215; '82, 211; '83, 220; '84, 228; '85, 249.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaurd, 1879-'82. Reports, '80, 1311; '81, 1428.

Capt. T. H. Handbury, 1881-'84. Reports, '81, 1510; '82, 1574; '83, 1166.

Maj. M. B. Adams, 1884. Report, '84, 1392.

Capt. H. S. Taber, 1885-'— Report, '85, 1594.

Operations.

1879-'80. 1,151 trees cut down, 130 snags removed, and 11 rock heaps destroyed, '80, 1311.

1880-'81. 270 snags and wreck of coal barge removed; 298 trees cut down, '81, 1429.

1881-'82. 279 snags removed, 2 sunken barges destroyed, and 122 trees cut down, '82, 1574.

1882-'83. 864 snags removed and 2,184 trees cut down, '83, 1167.

1883-'84. 93 snags removed and 95 trees cut down, '84, 1392.

After 1884 operations were carried on under separate appropriations for White and Saint Francis rivers.

Projects.

In 1873 Maj. Suter recommended the improvement of both the White and Saint Francis rivers by removal of snags, logs, wrecks, and similar obstructions from their existing channels, and also of leaning trees from the banks, '73, 492. No definite amount was estimated for the completion of this project, and the work of improvement was carried on upon both rivers by joint appropriations until June 30, 1884, '86, 1378. Separate appropriations were made for these rivers in 1884 and 1886.

WHITE RIVER HARBOR, MICH.—IMPROVEMENT OF.

(Continued from Vol. I, p. 583.)

Appropriations.

1867-'79	\$203,050
1880.....	5,000, '80, 2017.
1881.....	7,500, '81, 2215.
1882.....	12,000, '82, 2302.
1884.....	10,000, '84, 1982.
1886.....	10,000, '86, 1763.

Total..... 247,550

1888..... 10,000, act of August 11, 1888.

Contracts.

1879. J. S. McCoughey, materials and labor for crib-work, '80, 2017.

1881. J. Corlett, for pier construction, '81, 2215.

1883. T. R. Lyon, for timber, '83, 1819. Keepers & Riddell, for iron, '83, 1819. Michigan Barge Company, for stone, '83, 1819. J. B. Smith & Co., for cedar bark, '83, 1819.

1887. S. Bedford, for timber, and Kelley, Maus & Co., for iron, '87, 2189.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 216; '81, 293; '82, 287; '83, 295; '84, 296; '85, 318; '86, 313; '87, 280.

ENGINEERS IN CHARGE.

Maj. F. Harwood, 1880-'82; Reports, '80, 2016; '81, 2213.

Maj. D. P. Heap, 1882-'83. Report, '82, 2302.

Capt. D. W. Lockwood, 1883-'—. Reports, '83, 1818; '84, 1981; '85, 2076; '86, 1762; '87, 2187.

Operations.

1879-'80. South pier extended 100 feet, '80, 2016.

WHITE RIVER HARBOR, MICH.—Continued.**Operations—Continued.**

- 1880-'81. South pier extended 100 feet and 200 linear feet of superstructure built over same; 4,486 cubic yards material dredged from the channel, '81, 2213, 2214.
 1881-'82. One crib and brush mattress foundation for bulkhead sunk, '82, 2302.
 1882-'83. Inner crib in south pier leveled up; piles driven for south wall foundation of second crib, '83, 1819.
 1883-'84. 3 cribs at end of south pier superstructured, '84, 1981.
 1884-'85. 752 linear feet of south pier pile revetments rebuilt, '85, 2078.
 1885-'86. 45 linear feet of outer section north pier cut down and rebuilt with superstructure, '86, 1763.
 1886-'87. Superstructure placed on 459 linear feet of old pile-pier revetment, '87, 2188.

Projects.

- By Maj. Wheeler, 1866, to secure a channel 200 feet wide and 12 feet deep, connecting Lake White and Lake Michigan, the channel to be maintained by pile protection and crib-piers. Estimated cost, \$170,530, '66, iii, 13; iv, 144, 145. Estimate increased, 1873, to \$220,445, '84, 1982.
 By Capt. Lockwood, 1881, for extension of south pier 200 feet and north pier 250 feet, and dredging between piers. Estimated cost, \$104,225, '84, 1982.
 From 1867 to 1886, inclusive, \$247,550 was appropriated.
 In 1887 it was estimated that \$84,225 would be required to complete the project, '87, 2188.

Surveys.**MAPS.**

'82, 2304; '84, 1982.

WHITE RIVER, IND.—IMPROVEMENT OF.

(Continued from Vol. I, p. 583.)

Appropriations.

1879.....	\$25,000
1880.....	20,000 '80, 1844.
1881.....	20,000 '81, 2007.
1882.....	20,000 '82, 1978.
1884.....	10,000 '85, 1643.
1886.....	7,500 '86, 279.
Total	102,500
1888.....	5,000, act of August 11, 1888.

Encroachments.

Evansville and Terre Haute Railroad Bridge an obstruction to navigation, '81, 2007.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 198; '81, 267; '82, 262; '83, 270; '84, 268; '85, 257; '86, 279; '87, 247.

ENGINEERS IN CHARGE.

Maj. J. A. Smith, 1878-'85. Reports, '80, 1842; '81, 2005; '82, 1975; '83, 1587; '84, 1765.

Maj. A. M. Miller, 1885-'86. Report, '85, 1642.

Maj. A. Stickney, 1886-'—. Reports, '86, 1586; '87, 1871.

ASSISTANT.

O. L. Petitdidier. Report, '87, 1871.

Operations.

- 1879-'80. 277 snags removed, '80, 1843.
 1880-'81. 218 snags removed from channel; barges built; 1,500 linear feet of logs framed into crib-work; quarry opened and material obtained for wing, dam, '81, 2005, 2006.
 1881-'82. 454 snags and 176 trees removed; 1,500 linear feet of round timber crib-work built; 2,491 cubic yards stone removed from cut at Kelly's Ripple; 375 linear feet of pile brush and stone wing-dams built at Thorne's Eddy, '82, 1976.
 1882-'83. 420 linear feet of crib-work extension at Kelly's Ripple; dredge built; 273 snags and 177 trees removed from channel, '83, 1588.
 1883-'84. 2,675 cubic yards stone removed from Kelly's Ripple, '84, 1765.
 1884-'85. 17,701 cubic yards rock removed from cut at Kelly's Ripple, '85, 1642.
 1885-'86. No operations, '86, 1587.
 1886-'87. 2,625 cubic yards rock removed from Kelly's Ripple, '87, 1871.

WHITE RIVER, IND.—Continued.**Projects.**

By Maj. Smith, 1879, for the formation of a channel with a clean depth of 2 feet from the mouth to Portersville on the East Fork, and Falls on the West Fork, by removal of snags and deepening channel by wing-dams and dikes, '79, 148, 1454; '81, 2007.

Modified in 1880 to obtain a channel $3\frac{1}{4}$ feet deep from mouth to Hazelton, by rock removed at Kelly's Ripple, dike construction, and removal of snags, '80, 1843; '87, 279.

From 1879 to 1886, inclusive, \$102,500 was appropriated. Amount estimated to complete project, \$17,500, '87, 247.

Surveys.**MAPS.**

Of Kelly's Ripple, '80, 1842.

WICOMICO RIVER (GREAT), VA.—SURVEY OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '84, 163.

ENGINEER IN CHARGE.

S. T. Abert, U. S. Agent. Report, '84, 1016, 1018.

Physical Characteristics.

Locality described, '84, 1017, 1018.

Plans.

By S. T. Abert, for a dredged channel 150 feet wide and 9 feet deep from Holland Point to Seine House Point, with a turning-basin at latter point. Estimated cost, \$46,419, '84, 1019.

Surveys.

Ordered by act of August 2, 1892. Made under direction of S. T. Abert, '84, 1018.

WICOMICO RIVER, MD.—IMPROVEMENT OF.

(Continued from Vol. I, p. 586.)

Appropriations.

1852-'79	\$33,000
1880	5,000, '80, 644.
1881	2,000, '81, 889.
1884	10,000, '85, 888.

Total..... 50,000

Appropriations prior to 1886, '87, 845.

Commerce.

Value of Salisbury exports, '80, 644; '82, 858.

Value of improvement, '82, 859.

Contracts.

1880. G. W. Parsons, for dredging, at 22 and 32 cents per cubic yard, chuted or scowed, '81, 889.

1883. G. W. Parsons, for dredging, at 22 and 30 cents per cubic yard, deposited or scowed, '83, 682.

1884. P. S. Ross, for dredging, at 17 cents per cubic yard, '85, 888.

Engineers.**CHIEF OF ENGINEERS.**

Repor.s, '80, 104; '81, 140; '82, 136; '83, 140; '84, 145, 151, 163; '85, 136; '86, 132; '87, 95.

ENGINEERS IN CHARGE.

Lient. Col. W. P. Craighill, 1871-'84. Reports, '80, 643; '81, 888; '82, 858; '83, 682; '84, 903, 959.

W. F. Smith, U. S. Agent, 1884-'—. Reports, '85, 868; '86, 869; '87, 844.

ASSISTANT.

N. W. Parsons. Report, '87, 845.

WICOMICO RIVER, MD.—Continued.**Operations.**

History of operations, '87, 845.

1879-'80. 11,213 cubic yards material dredged from channel, '80, 643.

1880-'81. 15,721 cubic yards material dredged and deposited behind dike, '81, 888.

1881-'82. 454 cubic yards material dredged, '82, 858.

1882-'83. No operations, '83, 682.

1883-'84. 4,000 cubic yards material dredged, '84, 905.

1884-'85. 20,327 cubic yards material dredged, '85, 888.

1885-'86. Dredging continued under Ross contract to completion of improvement, '86, 869; '87, 844.

Private and Corporate Work.

Dredging done by the citizens of Salisbury, '84, 903.

Projects.

By Lieut. Col. Craighill, 1871, for the formation of a channel 70 feet wide and 7 feet deep at low water from the mouth to the town of Salisbury, part of the dikes to be built by private parties, '71, 661, 663; '72, 685; '75, ii 70.

In 1884 the project was modified to give increased width to the channels and to straighten them at bends, '84, 959; '87, 96.

The work was completed in 1885 under aggregate appropriations of \$50,000, '87, 844.

Surveys.

Examination ordered by act of August 2, 1882. Made, 1882, under direction of Lieut. Col. Craighill, '84, 959.

River worthy of improvement but work not a public necessity, '84, 960.

WILLAMETTE RIVER, OREG., below Portland. (See COLUMBIA RIVER, LOWER, OREG.)**WILLAMETTE RIVER (UPPER), OREG.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 591.)

Appropriations.

1871-'79	\$103,500
1880	12,000, '80, 2277.
1881	15,000, '81, 2555.
1882	5,000, '82, 2658.
1884	10,000, '84, 2229.
1886	10,000, '86, 1941.

Total 155,500

1888 29,000, act of August 11, 1888.

Statement of appropriations, '86, 1941; '87, 2519.

Commerce.

Obstruction to navigation from bridge at Portland, '81, 2553; '82, 2656.

List of vessels on the Willamette route, '84, 2229.

Contracts.

1881. J. Paquet, for rock removal, at \$7.40 per cubic yard, '81, 2553, 2556.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 238; '81, 326; '82, 319; '83, 332; '84, 336; '85, 369; '86, 358; '87, 331.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1878-'81. Reports, '80, 2275; '81, 2553.

Capt. C. F. Powell, 1881-'84. Reports, '82, 2654; '83, 2038; '84, 2226.

Maj. W. A. Jones, 1884-'—. Reports, '85, 2424; '86, 1940; '87, 2517, 2518.

ASSISTANT.

R. A. Habersham. Reports, '80, 2278; '81, 2556; '82, 2659.

Operations.

History of operations previous to 1879, '80, 2280.

1879-'80. 586 snags removed, 700 linear feet temporary wing-dams built, and scraping on six bars, '80, 2275, 2278, 2288.

WILLAMETTE RIVER (UPPER), OREG.—Continued.**Operations—Continued.**

- 1890-'81. 1,121 snags removed, 600 linear feet wing-dams built, scraping on bars, and 497 cubic yards rock removed by blasting on Rook Island Rapids, '81, 2553, 2557.
 1881-'82. 524 snags removed; scraping on bars, '82, 2655, 2659.
 1882-'83. 913 snags removed, scraping on bars, and bank protection placed, '83, 2038.
 1883-'84. 43 snags removed, '84, 2226.
 1884-'85. 1,332 snags removed, '85, 2425.
 1885-'86. 1,192 snags removed and 200 linear feet of wing-dams built, '86, 1940.
 1886-'87. 100 linear feet wing-dams built and 40 snags removed, '87, 2517.

Physical Characteristics.

- Stages of water on upper river, '80, 2279; '81, 2550.
 Description of bars, '80, 2281.
 Threatened cut-off at Corvallis, '87, 2518.

Plans.

- By Maj. Jones for protection of river bank at Corvallis from a cut-off. Estimated cost, \$14,000, '87, 2519.

Private and Corporate Work.

- Works of the Willamette Transportation Company at Oregon City, '80, 2281.

Projects.

- The projects for the improvement of the Upper Willamette River, between Portland and Corvallis, a distance of 114 miles, was adopted in 1870, and consisted in the removal of snags and the improvement of the channel at rapids by scraping, removal of wreck, bowlders, and gravel, and the construction of wing-dams, '71, 905; '80, 2284. From 1871 to 1877, \$71,500 was appropriated, '78, 1329.
 In 1878 a project was submitted for the construction of cut-off and wing-dams above Corvallis, the construction of a new snag-boat, and the improvement of the rapids at Bissell's and Dove's Rocks. Estimated cost, \$40,000, '78, 1329.
 In 1886 an aggregate of \$155,500 having been appropriated, it was estimated that \$29,000 would be required to complete the project, '86, 1941.

WILLAPAH RIVER, WASH.—EXAMINATION OF.**Engineers.**

- CHIEF OF ENGINEERS.
 Report, '85, 369.
 ENGINEER IN CHARGE.
 Capt. C. F. Powell. Report, '85, 2420.

Physical Characteristics.

- Description of, '85, 2420.

Plans.

- Capt. Powell, 1884, estimates \$1,500 as cost of clearing lower river of snags and similar obstructions, but does not consider such an improvement a present necessity, '85, 2422.

Surveys.

- Ordered by act of July 5, 1884. Made, 1884, under direction of Capt. Powell, '85, 2420.

WILMINGTON HARBOR, CAL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 593.)

Appropriations.

1871-'79	\$487,000
1880	35,000, '80, 2233.
1881	33,000, '81, 2469.
1882	100,000, '82, 2533.
1884	50,000, '84, 2187.
1886	75,000, '86, 1940.
Total	780,000
1888	90,000, act of August 11, 1888.

WILMINGTON HARBOR, CAL.—Continued.**Contracts.**

1880. J. Hackett, for reef and sand removal, at \$3 and 50 cents per cubic yard, respectively, '81, 2469.
 1881. Tilford & Terkelson Brothers, for stone, at \$2.50 per ton, '81, 2469.
 1882. Pacific Coast and Reclamation Company, for reef and sand removal, at \$2.49 and 50 cents per cubic yard, respectively, '83, 1967.
 1885. E. A. Von Schmidt, for stone, at \$1.97 per ton, '85, 2336.
 1886. A. W. Von Schmidt, for dredging, at 23 $\frac{1}{2}$ cents per cubic yard, '87, 2430.
 E. A. Von Schmidt, for stone, at \$2.23 per ton, '87, 2430.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 234; '81, 321; '82, 315; '83, 327; '84, 331; '85, 358; '86, 351; '87, 319.

ENGINEERS IN CHARGE.

Lieut. Col. G. H. Mendell, 1871-'86. Reports, '80, 2232; '81, 2465; '82, 2531; '83, 1966; '84, 2186; '85, 2333; '86, 1911.

Maj. W. H. H. Benyaurd, 1886-'—. Report, '87, 2429.

ASSISTANTS.

A. J. Swift. Report, '83, 1967.

A. Boschke. Report, '84, 2187.

W. P. Smith. Report, '85, 2336.

Operations.

- 1879-'80. 4,483 tons stone deposited on the harbor jetties, '80, 2232.
 1880-'81. 13,242 cubic yards material dredged from the reef; 1,448 tons stone delivered on jetties, '81, 2466.
 1881-'82. 11,492 tons stone delivered and placed on lines of work; repairs made on 970 linear feet of inner portion of timber jetty; wreck of Adelaide Cooper removed from channel, '82, 2531, 2532.
 1882-'83. 26,550 cubic yards hard material and 1,870 cubic yards sand removed from reef; 1,313 cubic yards sand dredged upon inner bar, '83, 1967, 1968.
 1883-'84. 11,851 cubic yards material dredged from the channel, '84, 2186.
 1884-'85. 5,284 tons stone delivered and placed in the work, '85, 2334.
 1885-'86. 12,011 tons stone delivered in east jetty, extending same 280 feet, '86, 1913.
 1886-'87. No operations, '87, 2430.

Projects.

- By Lieut. Col. Mendell, 1871, for protection of harbor and channel entrance at Wilmington by construction of 6,700 linear feet of timber and stone breakwater. Estimated cost, \$400,000, '71, 947. For protection of work, \$30,000, '74, ii, 370. For completion, \$100,000, '76, ii, 617; '80, 2232.
 By Lieut. Col. Mendell, 1881, for an increase in channel depth from 10 feet to 15 feet at low water, by excavation of the reef to a width of 400 feet, extension of jetties beyond Deadman's Island in the bay of San Pedro to a depth of 18 feet, excavation of sand between jetties, and the elevation of existing works to 2 feet above high water. Estimated cost, \$291,766, '81, 2467; '86, 1912. Causes for increased cost, '85, 2335, 2336; '86, 1913.
 From 1871 to 1886, inclusive, \$780,000 has been appropriated. Estimated cost of completion of project, \$175,000, '86, 1914; '87, 2430.

WILMINGTON HARBOR, DEL.—IMPROVEMENT OF.

(Continued from Vol. I, p. 594.)

Appropriations.

1836-'79	\$105,856
1880	10,000, '80, 586.
1881	50,000, '81, 771.
1882	50,000, '82, 758.
1884	25,000, '84, 826.
1886	18,750, '86, 858.

Total..... 259,606

1888..... 30,000, act of August 11, 1888.

Statement of appropriations, '86, 857; '87, 828.

Contracts.

1879. T. Cumings, for rock removal, at \$28.50 per cubic yard, '80, 587.

WILMINGTON HARBOR, DEL.—Continued.**Contracts—Continued.**

1880. National Dredging Company, for dredging, at 24.75 cents per cubic yard, '81, 771.
 1881. I. Neveling & Son, for jetty construction, '82, 760. National Dredging Company, for dredging, at 31 cents per cubic yard, '82, 760. Delaware and Chesapeake Improvement Company, for dredging, at 29½ cents per cubic yard, '83, 620. I. Neveling & Son, for jetty construction, '82, 621.
 1884. I. Lunt, for jetty construction, '85, 870. American Dredging Company, for dredging, at 17 cents per cubic yard, '85, 871.
 1887. National Dredging Company, for dredging, at 12 cents per cubic yard, '87, 829.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 94, 98; '81, 122; '82, 120; '83, 120; '84, 130; '85, 127; '86, 124; '87, 87.

BOARD OF ENGINEERS.

For river and harbor improvements. Reports, '81 775; '82, 765. (See PROJECTS.)

ENGINEERS IN CHARGE.

Col. J. N. Macomb, 1877-'82. Reports, '80, 585; '81, 769, 771; '82, 761.
 Capt. W. Ludlow, 1882-'83. Report, '82, 756, 758.
 Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 620.
 Maj. W. H. Heuer, 1884-'85. Report, '84, 826.
 W. F. Smith, U. S. Agent, 1885-'—. Reports, '85, 869; '86, 857; '87, 827.

ASSISTANTS.

J. H. Dager. Report, '83, 621.
 T. Valentine. Report, '84, 826.

Operations.

1879-'80. 70 cubic yards rock removed, '80, 586.
 1880-'81. 35,630 cubic yards mud dredged, completing project of 1871, '81, 769.
 1881-'82. 38,290 cubic yards material dredged; work on jetty begun, '82, 757.
 1882-'83. 1,100 linear feet of jetty completed; 120,078 cubic yards material dredged, '83, 620.
 1883-'84. 700 cubic yards stone filling placed and 1,420 linear feet stone pavement laid, '84, 826.
 1884-'85. 9,571 cubic yards material dredged; jetty raised for entire length, '85, 870.
 1885-'86. Sunken crib removed; light-house wharves removed; 3,650 cubic yards material dredged, '86, 857.
 1886-'87. 168,787 cubic yards material dredged under contract, '87, 827.

Projects.

By Lieut. Col. Kurtz, 1870, for securing channel in Christianna River, from 100 to 200 feet wide and 12 feet deep at low water, by dredging and blasting. Estimated cost, \$83,000, '74, ii, 137. Increased by Col. Macomb, 1879, to \$93,000, '79, 441. Completed at a cost of \$83,500, '81, 769.
 By Col. J. N. Macomb, 1881, for construction of jetty at harbor entrance, dredging 15-foot channel from entrance to Pulp Works and 12-foot channel from thence to Delaware Railroad Bridge. Estimated cost, \$175,551, '81, 770, 774. Increased, 1883, by Lieut. Col. G. Weitzel to \$191,384, for a channel 150 feet wide and 15 feet deep from mouth to Delaware Railroad Bridge, '83, 622.

Surveys.

From mouth of river to Delaware Railroad Bridge ordered by act of March 3, 1879, '80, 98. Made, 1880, under direction of Col. Macomb, '81, 771.

MAPS.

Detail of north jetty, '82, 767; '87, 828.

WILMINGTON, N. C. (See CAPE FEAR RIVER.)**WILSON HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 595.)

Appropriations.

1875-'79 \$20,000
 1880 10,000, '80, 2205.
 1443 EN—36

WILSON HARBOR, N. Y.—Continued.**Appropriations—Continued.**

1881.....	10,000, '81, 2431.
1882.....	10,000, '82, 2442.
1886.....	10,000, '86, 1886.

Total	60,000
1888.....	5,000, act of August 11, 1888.

Contracts.

1881. W. D. Taylor, for iron, '81, 2433. W. J. Harris, for materials and labor, '81, 2433. W. E. Hingston, for materials and labor, '81, 2433. W. D. Taylor, for iron, '81, 2433.
 1892. A. J. Packard, for iron, '83, 1940. W. J. Harris, for pier extension, '83, 1940.
 1886. G. Elias & Brother, for timber, '87, 2366. M. S. Vosburgh, for stone, '87, 2366.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 230; '81, 316; '82, 310; '83, 318; '84, 322; '85, 346; '86, 341; '87, 306.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1875-'83. Reports, '80, 2205; '81, 2430; '82, 2437.

Lieut. Col. H. M. Robert, 1883-'85. Reports, '83, 939; '84, 2133.

Capt. E. Maguire, 1885-'86. Reports, '85, 2268; '86, 1885.

Capt. C. F. Palfrey, 1886. '87, 2366.

Capt. F. A. Mahan, 1886-'—. Report, '87, 2366.

Operations.

1881-'82. West pier extended 302 linear feet and east pier 213 feet, '82, 2437.

1882-'83. 90 linear feet of pier-work placed in extension of the west pier; 3,473 cubic yards material dredged from channel, '83, 1939.

1883-'84. West pier extended 30 feet and east pier 120 feet, '84, 2133, 2134.

1884-'87. No operations, '85, 2268; '86, 1885; '87, 2366.

Projects.

By Maj. Wilson, 1873, for extension of the piers to 12 feet and dredging in the channel between the piers, so as to give a channel 12 feet deep. Estimated cost, \$90,000, '73, 392, '75, i, 58, 323; '76, ii, 575, 576.

By Lieut. Col. McFarland, 1877, for dredging, increasing the estimated cost to \$100,000, '77, 975.

From 1875 to 1886, inclusive, \$80,000 had been appropriated, '87, 306.

WINNIBIGOSHISH LAKE. (See MISSISSIPPI RIVER, RESERVOIRS AT HEAD-WATERS OF, FIRST DIVISION.)**WINNIPESEOGEE LAKE, N. H. (See LAKE WINNIPESEOGEE, N. H.)****WINTHROP HARBOR, MASS.**

Examination ordered by act of August 5, 1886, '87, 31. [\$1,000 appropriated by act of August 11, 1888.]

WINYAW BAY, S. C.—IMPROVEMENT OF.**Appropriations.**

1886.....	\$18,750, '87, 1079.
1888.....	100,000, act of August 11, 1888.

Commerce.

Present and prospective, '85, 1154; '87, 1080.

WINYAW BAY, S. C.—Continued.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '81, 168; '82, 164; '85, 177; '87, 136.

ENGINEERS IN CHARGE.

Capt. J. Mercur, 1881-'85. Report, '82, 1122.

Capt. W. H. Bixby, 1885-'— . Reports, '85, 1154; '87, 1078.

ASSISTANTS.

C. M. Yeates. Report, '82, 1124.

R. Whitford. Reports, '85, 1155, 1165; '87, 1090.

Plans.

In 1881 Capt. Mercur considered that by a concentration of the tidal currents upon the bar by means of two submerged jetties a channel from 12 to 15 feet deep and 1,800 feet wide could be obtained over the bar. Estimated cost, \$1,500,000, '82, 1123; '85, 1159.

Projects.

By Capt. Bixby, 1885, to secure a permanent channel of entrance over the bar from 15 to 20 feet deep at mean low water by the construction of two converging lines of jetties. Estimated cost, \$2,500,000, '85, 1164; '87, 1078.

Surveys.

Examination ordered by act of March 3, 1881. Made, 1881, under direction of Capt. J. Mercur, '82, 1122.

Of entrance ordered by act of July 5, 1884. Made, 1885, under direction of Capt. Bixby, '85, 1157.

MAPS.

'85, 1164.

WISCONSIN AND FOX RIVERS. (See FOX AND WISCONSIN RIVERS.)**WITBLACOGCHIE RIVER, FLA.—IMPROVEMENT OF.****Appropriations.**

1881.....	\$7,500, '81, 1198.
1884.....	3,000, '84, 1196.
1886.....	3,000, '86, 1156.
1888.....	5,000, act of August 11, 1888.

Commerce.

Statement of commerce to be affected by improvement, '85, 1279; '87, 1249.

Contracts.

1887. C. S. Baker, for removal of obstructions, '87, 1250.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 140; '81, 185; '82, 181; '83, 193; '84, 201; '85, 198; '86, 197; '87, 160.

ENGINEERS IN CHARGE.

Maj. A. N. Dammrell, 1879-'85. Reports, '80, 1110; '81, 1197; '82, 1275; '83, 1001; '84, 1194.

Capt. W. T. Russell, 1885. Report, '85, 1277.

Lieut. W. M. Black, 1886-'—. Reports, '86, 1155; '87, 1248.

ASSISTANT.

Maj. J. L. Meigs. Report, '80, 1111.

Operations.

1881-'82. 648 snags, 99 trees, and 200 cubic yards of rock removed from 4 miles of river, '82, 1275.

1882-'83. Removal of snags, logs, and similar obstructions continued, '83, 1002.

1883-'84. No operations, '84, 1194.

1884-'85. 497 cubic yards rock and 36 logs removed from the river, and 23 yards rip-rap dam built, '85, 1277.

1885-'86. No operations, '86, 1156.

1886-'87. Removal of obstructions between Pemberton's and Hays' ferries, '87, 1248.

Physical Characteristics.

Measurements of discharge, '80, 1112.

WITHLACOOCHIE RIVER, FLA.—Continued.**Projects.**

By Maj. Damrell, 1880, for improvement of the river from its mouth to Hays' ferry, a distance of 100 miles, by removal of snags, overhanging trees, and loose rocks, and cutting through shoals and a bar at mouth. Estimated cost, \$23,874, '80, 1111.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Damrell, '80, 1110.

WOLF LAKE, IND.—EXAMINATION OF.

(Continued from Vol. I, p. 597.)

Engineers.

CHIEF OF ENGINEERS.

Report, '85, 314.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard. Report, '85, 2056.

Physical Characteristics.

Described, '85, 2056.

Plans.

In 1884 Maj. Benyaard did not consider the locality as worthy of improvement, '85, 2057.

Surveys.

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Maj. W. H. H. Benyaard, '85, 2056.

WOLF LAKE OUTLET, IND.—RESURVEY OF.

(Continued from Vol. I, p. 597.)

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 212.

ENGINEER IN CHARGE.

Maj. G. J. Lydecker, 1879. Report, '80, 1999.

Plans.

By Maj. Lydecker, 1880, for improvement of Wolf Lake Outlet into Lake Michigan by excavation of a channel from the shore to deep water in the latter and construction of piers for the protection of the channel. Estimated cost, for first plan, \$156,000; for modification of same, \$162,000. Maj. Lydecker prefers the second plan, but states that there is no occasion for a harbor of refuge at this place and that commerce does not warrant the improvement, '80, 2000.

Surveys.

Resurvey of outlet to Wolf Lake ordered by act of March 3, 1879. Made, 1880, under direction of Maj. Lydecker, '80, 1999.

MAPS.

'80, 2000.

WOLF RIVER, WIS.—SURVEY OF.

(Continued from Vol. I, p. 597.)

Commerce.

Commerce prospective upon improvement, '80, 1981, 1982.

Engineers.

CHIEF OF ENGINEERS.

Report, '80, 210.

WOLF RIVER, WIS.—Continued.**Engineers—Continued.****ENGINEER IN CHARGE.**

Maj. D. C. Houston. Report, '80, 1978.

ASSISTANT.

J. Pierpont. Report, '80, 1979.

Plans.

By Maj. Houston, 1879, for improvement of the river from Semple's Bridge to Shawano by excavation of a channel 80 feet wide and 3½ feet deep at low water. Estimated cost, \$43,500; no great demand for the improvement, '80, 1978, 1981.

Surveys.

Ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Houston, '80, 1978.

WOODBIDGE CREEK, N. J.—IMPROVEMENT OF.

(Continued from Vol. I, p. 598.)

Appropriations.

1879.....	\$4,000
1880.....	5,000, '80, 546.
1881.....	5,000, '81, 709.
1882.....	5,000, '82, 700.

Total	19,000
-------------	--------

Commerce.

The creek an outlet for products of fire-clay works, '82, 700.

Contracts.

1880. E. Brainard, for dredging, at 58 cents per cubic yard, '81, 709.

1881. J. Van Patten, for dredging, at 65 cents per cubic yard, '81, 710.

1882. E. Brainard and T. H. Benton, for dredging, at 65 cents per cubic yard, '83, 583.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 88; '81, 111; '82, 112; '83, 109; '84, 116; '85, 107; '86, 109; '87, 71.

ENGINEER IN CHARGE.

Lieut. Col. N. Michler, 1880-'82. Reports, '80, 546; '81, 708.

Lieut. Col. G. L. Gillespie, 1882-'85. Reports, '82, 699; '83, 582; '84, 749; '85, 754.

Lieut. Col. W. McFarland, 1885-'86. Report, '86, 781.

Lieut. G. McC. Derby, 1886-'— . Report, '87, 770.

Operations.

1879-'80. Cut 80 feet wide and 9 feet deep dredged through shoal above Valentine's Dock, '80, 546.

1880-'81. 12,554 cubic yards material dredged from the creek, '81, 709.

1881-'82. 7,324 cubic yards material dredged from the creek, '82, 700.

1882-'83. 6,880 cubic yards material dredged from the creek, '83, 582.

1883-'87. No operations, '84, 750; '85, 755; '86, 782; '87, 770.

Projects.

By Col. Macomb, 1879, to widen stream near Salamander Dock, dredging through shoal near Valentine's Dock, and constructing a pile revetment for the purpose of straightening the banks in that vicinity to procure a uniform depth of 12 feet at mean high water, width of channel to be 80 feet from mouth to Salamander Dock. Estimated cost, \$13,800, '79, 67, 478, 479, 480; '86, 781. Estimate revised in 1884 to \$29,000, '84, 750; '86, 782; '87, 770.

WOODBURY CREEK N. J.—IMPROVEMENT OF.**Appropriation.**

1882.....	\$5,000, '83, 641.
-----------	--------------------

Engineers.**CHIEF OF ENGINEERS.**

Reports, '83, 126; '84, 135; '85, 123; '86, 121; '87, 82.

WOODBURY CREEK, N. J.—Continued.**Engineers—Continued.****ENGINEERS IN CHARGE.**

Lieut. Col. G. Weitzel, 1883-'84. Report, '83, 641.

Maj. W. H. Heuer, 1884-'85. Report, '84, 638.

Lieut. Col. H. M. Robert, 1885-'— Reports, '85, 650; '86, 643; '87, 808.

ASSISTANTS.

E. A. Glasco. Report, '88, 642.

A. Stierke. Report, '84, 636.

Operations.

Operations suspended until available funds will permit of the formation of proposed channel in a single season, '87, 809.

Projects.

By Lieut. Col. Weitzel, 1883, for improvement of the creek by excavation of a channel of navigable width and 8 feet depth at high stage of water, from the Delaware River to Broad Street Bridge, in the town of Woodbury. Estimated cost, \$15,000, '83, 642.

Surveys.

Made, 1883, under direction of Lieut. Col. G. Weitzel, '83, 641.

WOOD ISLAND HARBOR, ME.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 60.

ENGINEER IN CHARGE.

Col. C. E. Blunt. Report, '85, 489.

Physical Characteristics.

Description of harbor, '85, 489.

Plans.

By Col. Blunt, 1885, for formation of harbor of refuge by construction of breakwater. Estimated cost, \$547,000, '85, 490.

Surveys.

Ordered by act of July 5, 1884. Made, 1885, under direction of Col. Blunt, '85, 489.

WOOD RIVER, OREG.

Examination ordered by act of August 5, 1886, '87, 330.

WOOD'S HOLL HARBOR, MASS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 508.)

Appropriations.

1882-'79	\$17,500
1882	52,000, '82, 550.
1884	25,000, '84, 680.
1886	14,500, '86, 592.

Total 109,000

Commerce.

Importance of improvement to, '80, 370.

WOOD'S HOLL HARBOR, MASS.—Continued.**Contracts.**

1879. G. W. Townsend, for removal of bowlders, at \$7 per cubic yard, '80, 368. J. McDermott, for dredging, at 24½ cents per cubic yard, '80, 368.
 1883. G. W. Townsend, for rock removal, at \$5 per cubic yard, '83, 473. I. A. Sylvester, for dredging, bowlder removal, riprap, and retaining and pier wall construction, '84, 598.
 1886. W. H. Molthrop & Co., for wharf construction, '87, 539. C. E. Davis, for rock removal, '87, 539.
 1887. Frank Pidgeon Dredging Company, for dredging, at \$1.10 per cubic yard, '87, 539. G. W. Townsend, for rock removal, '87, 540.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 73; '81, 79; '82, 79; '83, 74; '84, 81; '85, 69; '86, 69; '87, 33.

ENGINEERS IN CHARGE.

Lieut. Col. G. K. Warren, 1873-'83. Reports, '80, 367; '81, 545; '82, 549.

Lieut. Col. G. H. Elliot, 1883-'87. Reports, '83, 472; '84, 597; '85, 590; '86, 591.

Maj. W. R. Livermore, 1887-'— . Report, '87, 537.

ASSISTANT.

J. P. Cotton. Report, '81, 546.

Operations.

1879-'80. 15,134 cubic yards material dredged from the channel at Little Harbor; 1,001 cubic yards rock and bowlders removed from Wood's Holl Straits, '80, 369, 370.

1880-'81. 71 cubic yards bowlders removed from the channel, '81, 545.

1881-'82. No operations, '82, 549.

1882-'83. Bowlders removed from site of proposed pier and wharves, '83, 473.

1883-'84. 6,622 cubic yards material dredged in excavation for foundation; 162 tons bowlders removed; 3,440 tons granite masonry and riprap laid in pier and retaining walls, '84, 599.

1884-'85. Masonry walls of pier-basin completed; interior of pier-basin and berths for vessels at wharves dredged to 15 and 18 feet, and coal, west, and the cross wharves completed, '85, 583.

1885-'86. No operations, '86, 591.

1886-'87. Construction of east and south wharves in progress; removal of rocks from the strait, '87, 537.

Physical Characteristics.

Description, '80, 367.

Tidal currents, '80, 370.

Importance of proposed pier and breakwater construction to United States fisheries, '82, 552.

Plans.

By Maj. Warren, 1873, for improvement of harbor by excavation of a channel 800 feet wide with a central depth of 18 feet at mean low water. Estimated cost, \$446,000, '80, 370; '81, 550.

Projects.

The appropriation of \$15,000 made in 1879 was expended in dredging and removing bowlders from the entrance to the harbor, '80, 369; '81, 545.

The project of 1882 proposed the construction of retaining walls on shore a hollow pier and wharves for the use of the Fish Commission and other branches of the public service, and removal of rocks from the straits. Estimated cost, \$52,775, '82, 550, 551; '84, 598.

In 1884 the project was modified by dredging in the rear of the coal wharf, '87, 538.

Surveys.

For pier and breakwater in "Great Harbor" Wood's Holl, '82, 550.

MAPS.

'80, 368; '81, 598; '84, 598.

WRECKS—REMOVAL OF.

Abbreviations: Bg., brig; Bk., bark; Brg., barge; C. b., canal-boat; Sc., scow; Sch., schooner; Sl., sloop; Sp., ship; S. s., steamship; Str., steamer.

Locality.	Description.	References.
Bayou Teche, La.	{ Str. J. M. Chambers	'85, 225, 1428; '87, 188.
Beaufort Harbor, N. C.	{ Str. Maria A	'87, 188, 1392.
Brigantine Shore, N. J.	Str. Wave	'87, 189, 1098.
Broadkill River, Del.	Str. Cassandra	'82, 126, 798; '83, 139, 660.
Cape Charles, Va.	Str. J. T. Van Dorn	'87, 98, 817.
Cape Cod, Mass.	{ Sch. Maria	'85, 159, 970.
Cape Fear River, S. C.	{ Sch. Elizabeth	'85, 159, 970.
Charlevoix Harbor, Mich.	{ S. s. Periklomen	'85, 80, 618.
Chesapeake Bay	{ Bg. Cho	'85, 175, 1000; '87, 139, 1098.
Chinotague Bay	{ Str. North Heath	'84, 300, 1995.
Connecticut River	{ Sch. J. B. Parsons	'83, 148, 725; '84, 948.
Delaware Bay	{ — Clara S.	'83, 148, 725; '84, 948.
Delaware River	{ — Cascatella	'85, 185, 878; '87, 101, 878, 879.
Detroit River, Mich.	{ Sch. Olephant	'85, 137, 890.
Fairport Harbor, Ohio	{ Brg.	'83, 148, 725; '84, 151, 948.
Hudson River	{ Bk. Wolverton	'87, 55, 637.
Little Egg Harbor, N. J.	{ Sl. G. C. Bloomer	'80, 607; '81, 822; '82, 797.
Lynn Haven Harbor	{ Sch. R. H. Daly	'87, 85, 813.
Maurice River, N. J.	{ Sch. Addie Walton	'87, 813.
Mobile River, Ala.	{ — R. H. Irons	'86, 848.
Nansemond River, Va.	{ — E. B. Wheaton	'86, 848.
Narragansett Bay, R. I.	{ — Helen Pommell	'82, 126, 798; '83, 660.
New Haven Harbor, Conn.	{ — Jessie Wilson	'84, 138, 850; '85, 855.
New Orleans	{ — J. B. Austin	'82, 298, 2975; '83, 1898.
New York Harbor	{ — M. A. McGahan	'86, 339, 1876.
Pamlico River, N. C.	{ — M. E. Smith	'83, 100, 550.
Pass Marianne, Miss.	{ — W. G. Dearborn	'84, 138, 850; '85, 855.
Patapeco River, Md.	{ Sp. Adolphus	'86, 159, 970.
St. John's River, Fla.	{ Sch. Kureka	'83, 139, 660.
San Francisco Harbor	{ Sl. Ann	'84, 206, 1217.
San Joaquin River, Cal.	{ C. b.	'86, 159, 970.
Scuppernon River, N. C.	{ Sp. Partfield	'87, 123, 990.
Sheboygan Harbor, Mich.	{ Sch. Anthea Godfrey	'82, 193, 1389; '83, 1130.
Tampa Harbor, Fla.	{ Sch. Trade Wind	'87, 101, 879.
	{ Bg. New York	'83, 186, 955.
	{ Bg. Uncle Sam	'82, 2636; '83, 1902; '84, 2202; '85, 2339;
	{ Str. Gertrude	'85, 1915; '87, 2426.
	{ Sch. Tarry Not	'85, 360, 2339.
	{ Sch. Mott Haven	'85, 164, 1044; '86, 970.
	{ Sch. Willie DeWolf	'84, 284, 1860.
	{ Sch. June	'85, 1279; '86, 1187; '87, 1256.
	{ S. s. Gresham	
	{ S. s. Alisa	
	{ S. s. General Grant	
	{ Bk. Samarang	
	{ Str. Nankin	
	{ Brg. Albemarle	
	{ Str. Concord	
	{ Bk.	
	{ Sl. Mary Jane	
	{ Str. Maple Leaf	
	{ S. s. Escambia	
	{ Brg.	
	{ Sch. Lawrence	
	{ Sch. Petrel	
	{ Str. Dictator	

YADKIN RIVER, N. C.—IMPROVEMENT OF.

(Continued from Vol. I, p. 599.)

Appropriations.

1879.....	\$20,000
1880.....	20,000, '80, 791.
1881.....	12,000, '81, 1027.
1882.....	25,000, '82, 1103.
1886.....	10,000, '86, 968.
Total.....	87,000
1888.....	10,000, act of August 11, 1888.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 117; '81, 165; '82, 161; '83, 168; '84, 173; '85, 162; '86, 157; '87, 133, 139.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. Agent, 1878-'81. Report, '80, 790.

Capt. J. Mercur, 1881-'84. Reports, '81, 1025; '82, 1102; '83, 864.

Capt. F. A. Hinman, 1884-'86. Reports, '84, 1045; '85, 1042; '86, 967.

Capt. W. H. Bixby, 1886-'—. Report, '87, 1061.

ASSISTANTS.

W. H. James. Reports, '81, 1027; '82, 1103; '83, 864; '84, 1045.

E. D. Thompson. Report, '87, 1063.

Operations.

1880-'81. 616 cubic yards solid rock, 150 cubic yards bowlders, and 55 trees, logs, and snags removed from the river, '81, 1026.

1881-'82. 4,468 cubic yards rock blasted and removed; 1,907 linear feet of wing-dams and training-walls built; 125 cubic yards timber and brush put in dams at Clinton and Swicegood shoals, '82, 1105.

1882-'83. 60 cubic yards sand and gravel dredged; 1,163 cubic yards rock blasted and removed; 226 linear feet wing walls and jetties built, '83, 865.

1883-'84. 1,136 cubic yards rock blasted and removed; 368 linear feet wing-dams built, '84, 1,045.

1884-'85. 2,138 linear feet wing-dams and training-walls built, '85, 1043.

1885-'86. 416 linear feet of wing-dam and 125 linear feet of training-wall built; also 150 linear feet of training-wall and 498 linear feet of wing-dam previously built raised and strengthened, '86, 967.

1886-'87. 358 linear feet of wing-dams built and 227 cubic yards rock removed from channel, '87, 1062.

Projects.

By S. T. Abert, 1879, for improvement of the river from Salisbury to the foot of Bean Shoals, a distance of 64½ miles, by dredging and rock excavation, to permit of a steam-boat navigation of 2½ to 3 feet low-water draught. Estimated cost, \$81,671, '79, 87, 647, 648; '83, 864. From 1879 to 1886, inclusive, \$87,000 was appropriated.

In 1887 it was considered that the final cost of the improvement would be \$400,000, '87, 133, 1063.

Surveys.

Examination from State line to the Narrows ordered by act of August 5, 1886, '87, 139.

MAPS.

'83, 864.

YALLABUSHA RIVER, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 600.)

Appropriations.

1881.....	\$3,500, '81, 1414.
1882.....	3,500, '82, 1555.
1884.....	2,000, '84, 1337.
1886.....	2,000, '86, 1363.

Total 11,000

Commerce.

Cotton production, '83, 1153.

YALLABUSHA RIVER, MISS.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 158; '81, 210; '82, 207; '83, 216; '84, 225, 226; '85, 240; '86, 235; '87, 199.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1879-'83. Reports, '80, 1348; '81, 1414; '82, 1554.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1152; '84, 1337, 1342.

Capt. E. Bergland, 1885-'87. Reports, '85, 1519; '86, 1363.

Capt. J. H. Willard, 1887-'— . Report, '87, 1473.

ASSISTANTS.

N. M. Rees. Report, '80, 1349.

N. S. Davis. Reports, '84, 1342; '85, 1590.

Operations.

1881-'82. 540 logs and snags removed and 694 trees destroyed, '82, 1554.

1882-'83. 3,966 trees, logs, and snags removed, '83, 1153.

1883-'84. No operations, '84, 1337.

1884-'85. 2,557 trees cut and girdled and 4,399 snags and logs removed, '83, 1590.

1885-'86. No operations, '86, 1363.

1886-'87. 2,329 snags, logs, and stumps removed and 12,425 trees cut, '87, 1474.

Physical Characteristics.

Description of, '80, 1348, 1349.

Plans.

In 1883 Maj. Miller did not consider that part of the river above Grenada as worthy of improvement, '84, 1342.

Projects.

By Maj. Benyaard, 1879, for improvement of the river from Grenada to its mouth, a distance of 63 miles, by removal of snags, sunken logs, leaning timber, etc. Estimated cost, \$7,000, '80, 1350; '87, 1473.

Additional expenditures required to maintain improvement, '87, 1473.

Surveys.

Examination ordered by act of March 3, 1879. Made, 1879, under direction of Maj. Benyaard, '80, 1348.

Examination of river above Grenada ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Miller. Improvement not considered a necessity, '84, 1342.

YAMHILL RIVER, OREG. (See WILLAMETTE RIVER, UPPER.)**YANKTON, DAK.—SURVEY AT.**

(See MISSOURI RIVER BETWEEN SIOUX CITY AND FORT BENTON.)

YAQUINA BAY, OREG.—IMPROVEMENT OF ENTRANCE TO.**Appropriations.**

1880.....	\$40,000, '80, 241.
1881.....	10,000, '81, 2593.
1882.....	60,000, '82, 2680.
1884.....	50,000, '84, 2265.
1886.....	75,000, '86, 2002.

Total 235,000

1888..... 150,000, act of August 11, 1888.

Commerce.

Results prospective upon improvement, '84, 2269.

Contracts.

1887. R. Ingram, for jetty stone, at 62 cents per ton, '87, 2466.

YAQUINA BAY, OREG.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 241; '81, 329; '82, 322; '83, 335; '84, 338; '85, 365; '86, 362; '87, 326.

ENGINEERS IN CHARGE.

Maj. G. L. Gillespie, 1880-'82. Report, '81, 2589.

Capt. C. F. Powell, 1882-'—, Reports, '82, 2679; '83, 2062; '84, 2265; '85, 2393; '86, 1998; '87, 2465, 2467.

ASSISTANT.

J. S. Polhemus. Reports, '81, 2593; '82, 2681; '83, 2064; '84, 2267; '85, 2395.

Operations.

History of the improvement, '81, 2595.

1880-'81. Preparations for work and collection of materials; 2,500 linear feet of tramway built; one crib with mattress foundation sunk; '81, 2592.

1881-'82. 90 linear feet of wharf built of crib-work and piling; also hoisting engine and derrick placed in position; 550 linear feet of jetty (brush and stone) built; '82, 2629.

1882-'83. Foundation jetty mat advanced 1,430 feet and the same ballasted and ripped with 6,600 cubic yards stone, '83, 2063.

1883-'84. Jetty extended 162 feet, consuming 9,352 cubic yards stone and 650 cords of brush, '84, 2265.

1884-'85. Land gap of 375 feet closed by jetty construction; tramway rebuilt; extensive repairs to plant, '85, 2394.

1885-'86. No operations, '86, 1998.

1886-'87. Operations resumed in construction of jetty, '87, 2465.

Physical Characteristics.

Description of bay and its tidal volume, '86, 2000; '87, 2468.

Plans.

By Capt. Powell, 1886, for final ballasting of present jetty and shore protection; present jetty extension 1,000 feet, half-tide north jetty 1,800 feet, and further extension of north and south jetties 1,200 and 700 feet, respectively. Estimated cost, \$543,970, '86, 2001.

Private and Corporate Work.

Funds donated by citizens of Willamette Valley for use on the Yaquina improvement, '82, 2679.

Projects.

By Maj. Gillespie, 1880, for construction of a high-tide brush mattress and stone jetty, about 4,000 feet long, on the south side of the entrance to Yaquina Bay, to close a rock-obstructed channel, and to provide a central free channel of increased depth. Depth to be obtained was placed, in 1881 at 17 feet, and subsequently raised to 19 feet at mean high tide. Estimated cost, \$465,000, '81, 329; '82, 2680; '87, 2465. In 1886, \$235,000 having been appropriated for the work, Capt. Powell proposed the construction of a north jetty, which, with the further extension of the south jetty, was estimated to cost \$308,970 additional to the amount already appropriated, '86, 2001; '87, 237, 2465.

Surveys.

Comparison of surveys of 1885-'86, '87, 2467.

MAPS.

'82, 2680; '83, 2066; '84, 2268; '85, 2396; '86, 2000; '87, 2465.

YAZOO RIVER, MISS.—IMPROVEMENT OF.

(Continued from Vol. I, p. 600.)

Appropriations.

1873-'79	\$107,000
1880	12,000, '80, 1310.
1881	6,000, '81, 1408.
1882	8,000, '82, 1548.
1884	10,000, '84, 1334.
1886	15,000, '86, 1358.

Total	158,000
1888	32,000, act of August 11, 1888.
Statement of appropriations, '87,	1470.

Commerce.

Traffic upon the river, '83, 1144.

YAZOO RIVER, MISS.—Continued.**Engineers.****CHIEF OF ENGINEERS.**

Reports, '80, 153; '81, 208; '82, 205; '83, 214; '84, 223, 227; '85, 237, 243; '86, 233; '87, 198.

ENGINEERS IN CHARGE.

Maj. W. H. H. Benyaard, 1873-'83. Reports, '80, 1310; '81, 1407; '82, 1547.

Maj. A. M. Miller, 1883-'85. Reports, '83, 1143; '84, 1333, 1355.

Capt. E. Bergland, 1885-'86. Reports, '85, 1507, 1537; '86, 1357.

Capt. J. H. Willard, 1886-—. Report, '87, 1467.

ASSISTANTS.

T. M. Farrell. Report, '84, 1356.

P. R. Starr. Report, '85, 1508.

Operations.

1879-'80. Wrecks of 2 steamers removed, also logs, snags, and similar obstructions, '80, 1310.

1880-'81. 250 snags and 2,194 trees removed and cut, '81, 1407.

1881-'82. 607 snags and wreck of steamer removed and 172 trees cut down, '82, 1547.

1882-'83. 545 snags removed and destroyed and 485 trees cut down, '83, 1144.

1883-'84. No operations, '84, 1333.

1884-'85. 894 snags and stumps and 1 steam-boat wreck removed from channel; also 1,773 trees cut and 6 jams removed, '85, 1507.

1885-'86. No operations, '86, 1358.

1886-'87. Summary of operations, '87, 1467.

Projects.

By Capt. Benyaard, 1874, for improvement of the river by construction of snag-boat and removal of wrecks, snags, logs, and similar obstructions, '74, i, 365.

From 1873 to 1886 \$158,000 was appropriated, '87, 1470.

Surveys.

Of Yazoo Pass with a view to connecting the pass with the Mississippi River ordered by act of August 2, 1882. Made, 1883, under direction of Maj. Miller, and not recommended for improvement, '84, 1355.

YELLOWBANKS, WIS. (See CHIPPEWA RIVER AT.)**YELLOWSTONE RIVER, DAK. AND MONT.—IMPROVEMENT OF.****Appropriations.**

1879.....	\$25,000
1880.....	15,000, '80, 1475.
1881.....	20,000, '81, 1676.
1882.....	20,000, '82, 1746.
1884.....	20,000, '85, 1660.
1886.....	18,750, '86, 1402.

Total 118,750

Commerce.

Increase in steam-boat business, '82, 1746.

Insignificant commerce of upper river, '87, 1662.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 170; '81, 231; '82, 228; '83, 234; '84, 238; '85, 259; '86, 249; '87, 216.

ENGINEERS IN CHARGE.

Capt. E. Maguire, 1879-'84. Reports, '80, 1475; '81, 1674; '82, 1743; '83, 1364, 1373.

Capt. J. B. Quinn, 1884-'86. Reports, '84, 1543; '85, 1659; '86, 1399.

Capt. C. B. Sears, 1886-—. Report, '87, 1601.

ASSISTANT.

F. M. Towar. Reports, '83 1373; '84, 1544.

YELLOWSTONE RIVER, DAK. AND MONT.—Continued.**Operations.**

- 1880-'81. 519 cubic yards rock taken out of channel, '81, 1675.
 1881-'82. 3,162 linear feet of brush and stone dam and shore protection built; 433 cubic yards rock removed, '82, 1743-1746.
 1882-'83. 6,806 fascines and 565 mats made and laid; 4,536 cubic yards rock and gravel placed in construction of dams and shore protection, '83, 1375.
 1883-'84. Repairs to dikes in vicinity of Glendive, '84, 1543.
 1884-'85. 2,504 linear feet of brush and stone dike built, '85, 1659.
 1885-'86. Outlets from main channel below Glendive closed by brush-dam construction, '86, 1399.
 1886-'87. No operations, '87, 1602.

Projects.

- By Lieut. Maguire, 1878, for improvement of the river by removal of rocks, snags, trees, and similar obstructions, and construction of wing-dams and shore protection for the unification of the channel. Cost indeterminate, '79, 1098.
 From 1879 to 1886, inclusive, \$118,750 was appropriated. Estimated cost to complete project in 1887, \$106,000, '87, 1603.

Surveys.

- Ordered by act of June 18, 1878. Made, 1879, under direction of Lieut. Maguire, '80, 1475.

MAPS.

- '82, 1744, 1746; '83, 1374.

YORK HARBOR, ME.—IMPROVEMENT OF.**Appropriations.**

- 1886..... \$15,000, '87, 462.
 1888..... 10,000, act of August 11, 1888.

Contracts.

- T. Symonds, for dredging, at 65 cents per cubic yard, '87, 463.

Engineers.**CHIEF OF ENGINEERS.**

- Reports, '85, 60; '87, 19.

ENGINEERS IN CHARGE.

- Col. C. E. Blunt, 1884-'85. Report, '85, 485, 487.
 Maj. J. A. Smith, 1885-'— Report, '87, 462.

ASSISTANT.

- C. Berrer. Report, '85, 485, 488.

Projects.

- By Col. Blunt, 1885, for improvement of York Harbor by dredging at obstructed points in the existing channel to obtain a uniform depth of 10 feet at low water. Estimated cost, \$25,000, '85, 487. Increased \$5,000 in 1887 by Maj. Smith, '87, 462.

Surveys.

- Examination ordered by act of July 5, 1884. Made, 1884, under direction of Col. Blunt, '85, 485.
 Survey made, 1885, '85, 487.

YORK RIVER, VA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 601.)

Appropriations.

- 1880..... \$10,000, '80, 778.
 1881..... 25,000, '81, 973.
 1882..... 25,000, '82, 1040.
 1884..... 20,000, '84, 995.
 1886..... 18,750, '86, 920.

Total..... 98,750

- 1888..... 30,000, act of August 11, 1888.

Statement of appropriations, '87, 946.

YORK RIVER, VA.—Continued.**Commerce.**

Probable increase in the shipment of cotton consequent upon improvement, '80, 777.

Contracts.

1880. National Dredging Company, for dredging, at 15 cents per cubic yard, '81, 972.

1881. National Dredging Company, for dredging, at from 16 to 20 cents per cubic yard, according to distance of dumping-ground, '82, 1039.

1882. Delaware and Chesapeake Improvement Company, for dredging, at 13 to 13½ cents per cubic yard, '83, 821.

1884. T. P. Morgan, for dredging, at 8½ cents per cubic yard, '85, 985.

1886. American Dredging Company, for dredging, at 9½ cents per cubic yard, '87, 946.

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 115, 125; '81, 155; '82, 151; '83, 157; '84, 159; '85, 149; '86, 144; '87, 110.

ENGINEERS IN CHARGE.

Capt. C. B. Phillips, 1879-'81. Report, '80, 776, 807.

S. T. Abert, U. S. Agent, 1881-'— Reports, '81, 971; '82, 1038; '83, 820; '84, 994; '85, 984; '86, 918; '87, 944.

ASSISTANT.

J. M. Wolbrecht. Report, '80, 898.

Operations.

1880-'81. 58,809 cubic yards material dredged from the channel, '81, 972.

1881-'82. 137,969 cubic yards dredged from West Point Channel, '82, 1039.

1882-'83. 135,696 cubic yards dredged from West Point Bar, '83, 821.

1883-'84. No operations, '84, 994.

1884-'85. 75,917 cubic yards dredged from the channel, '85, 985.

1885-'86. 87,421 cubic yards dredged from the channel, '86, 919.

1886-'87. 140,162 cubic yards dredged from the channel, '87, 946.

Projects.

By Capt. Phillips, 1880, for improvement of the river from West Point to the mouth by excavation of a channel 400 feet wide and 22 feet deep at low water, with the formation of a basin in front of the wharves. Estimated cost, \$255,000, '80, 777; '85, 984; '87, 946.

Modified in 1887 by the addition of a dike extending from the bank opposite West Point, increasing the total estimate to \$309,750, '87, 946.

Surveys.

Ordered by act of March 3, 1879. Made, 1880, under direction of Capt. Phillips, '80, 897.

MAPS.

'85, 986; '87, 946.

Vicinity of West Point, '86, 919; '87, 946.

YOUGHIOGHENY RIVER, PA.—IMPROVEMENT OF.

(Continued from Vol. I, p. 601.)

Appropriation.

1875..... \$10,000

Engineers.**CHIEF OF ENGINEERS.**

Reports, '80, 195; '81, 263; '84, 263.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1880. Reports, '81, 1957; '84, 1716.

Physical Characteristics.

Description of river and resources of adjacent country, '81, 1968.

Plans.

By Lieut. Col. Merrill, for construction of lock and dam on the Lower Youghio-gheny River. Estimated cost, \$230,000, '81, 1968.

Surveys.

Ordered by act of June 14, 1880. Made, 1880, under direction of Lieut. Col. Mer-rill, '81, 1957.

Ordered by act of August 2, 1882. Made, 1882, under direction of Lieut. Col. Mer-rill, '84, 1716.

**YOUNG'S, LEWIS AND CLARK'S, AND SKIPANON RIVERS,
OREG.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '81, 333; '82, 324.

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '82, 2714.

Physical Characteristics.

Description of, '82, 2714.

Plans.

By Capt. Powell, 1881, for extension of navigation on the Young's, and Lewis and Clark's rivers, to give 6 feet at low water to the head of tide, and the removal of snags in the Skipanon. Estimated cost, \$20,500, '82, 2715, 2716.

Surveys.

Ordered by act of March 3, 1881. Made, 1882, under the direction of Capt. Powell, '82, 2714.

YUBA RIVER, CAL.—EXAMINATION OF.**Engineers.****CHIEF OF ENGINEERS.**

Report, '85, 363.

ENGINEER IN CHARGE.

Capt. A. H. Payson. Report, '85, 2373.

Plans.

Capt. Payson, 1885, reports that there is nothing to be gained by the proposed improvement, '85, 2374.

Surveys.

Examination ordered by act of July 5, 1884. Made under direction of Capt. Payson, '85, 2373.



TOPICAL INDEX

OF

ENGINEERING AND PHYSICAL DATA, ETC.,

COMPILED FROM THE

REPORTS OF THE CHIEF OF ENGINEERS, U. S. ARMY,

1880-1887, INCLUSIVE.

[Continued from Vol. I, pp. 1-29.]

[This index has been confined to the Reports on River and Harbor Improvements.]

Adams' Flume for improvement of rivers, '80, 177; '81, 238; '82, 1755; '83, 242; '84, 244.

Anchorage, area required for various vessels, '84, 585.

Determination of harbor capacity for, '84, 579; '85, 531.

Appropriations for Rivers and Harbors. (See list at end of Index.)

Aqueduct, Washington, D. C., '85, 2453, 2496; '87, 902. (See Washington Aqueduct in Index of Works.)

Across Tennessee River, '85, 1758.

Banks. (See Levees, Shore protection.)

Barometers. Comparison of mercurial and aneroid, '81, 451.

Bars. (See River bars.)

Batteries for firing explosives. (See Explosives.)

Beach protection. (See Shore protection.)

Beams. Tests of wooden, '83, 1486.

Best form for ends of, '83, 1486.

Bear-trap dams. (See Dams.)

Beton. (See Concrete.)

Blasting. (See Rock removal.)

Boats. (See Vessels.)

Bolts. (See Drift bolts and Screw bolts.)

Borings. (See Surveys.)

Breakwater.

(See also Piers and Harbors of Refuge.)

1. *General considerations.* 2. *Dimensions of, alphabetically arranged.* 3. *Construction of.* 4. *Cost of.*

1. GENERAL CONSIDERATIONS.

Breakwaters. Superiority of riprap construction, '87, 578.

Wave force impressed upon, '84, 573. (See also Waves.)

2. DIMENSIONS.

Dimensions at Bar Harbor, Me., '87, 483.

— Block Island, R. I., '85, 612.

— Buffalo, N. Y., '87, 2356.

— Calais, '82, 486.

— Chicago, Ill., '81, 2153, 2158, 2164.

— Columbia River, Oreg., '80, 2319, 2320.

— Delaware Breakwater, '86, 840.

— Duck Island, Conn., '87, 642, 644.

— European Breakwater, '82, 486; '87, 2364.

— Gloucester, Mass., '87, 504.

— Mackinac, Mich., '80, 2055.

— Manora, East Indies, '81, 1064.

— Milwaukee, Wis., '81, 2118.

— Moose-a-bee, Me., '86, 534.

— Oswego, N. Y., '80, 2215.

Breakwaters—Continued.

- Dimensions at Port Orford, Oreg., '81,*
264⁴, 2694.
— Richmond Island, Me., '81, 490.
— Rockland, Me., '81, 464, 466.
— Rouse's Point, N. Y., '85, 229⁸, 2299,
2301.
— Sandy Bay, Mass., '84, 571; '86, 582.
— San Louis Obispo, Cal., '81, 2526;
'87, 2434.
— Scituate, Mass., '81, 522.
— Vineyard Haven, Mass., '87, 577,
580.

3. CONSTRUCTION.

- Best form of top, '84, 573.
Slopes, general discussion of, '84, 573.
— developed by waves, '84, 572, 573.
— of various. (See Dimensions.)
Concrete superstructure, use of, '82, 793,
2270; '86, 119, 2650, 2674; '87,
483, 504, 2060, 2069, 2111, 2353,
2363. (See also Concrete.)
— failure of, '81, 2674.
Tight decking, importance of, '80, 2215,
'84, 2144.
Spur-cribs, use of, at Oswego, N. Y.,
'84, 2148, 2150.
Injury at Buffalo from ice, '87, 2352.
— Oswego from storms, '87, 2279.
Parapet form for superstructure. (See
Cribes.)
Ratio between volume of stone and
space filled, '86, 840.

4. COST.

- Cost of*, at Cleveland, Ohio, '80, 2142,
2145.
— Delaware, '86, 840.
— New Haven, Conn., '80, 455; '81,
595.
— Oswego, N. Y., '80, 213, 2217.
— Portsmouth, N. H., '80, 342; '81,
500.
— Rockland, Me., '81, 464; '82, 492.

Bridges.

Bridges over navigable rivers, general
consideration of, '80, 1849; '81,
2009; '82, 1979; '83, 1591; '84,
1769; '85, 1917; '86, 2111;
'87, 263.

Effect of present laws, '82, 2008.

Losses to commerce by collision with,
'82, 1925.

Design of Aqueduct, D. C., '82, 2037;
'86, 934, 942; '87, 902, 908.

— Potomac River, D. C., '86, 897.

(See also Bridges in Index of Works.)

Brownlow-weed dikes, inferior
to wire curtains, '80, 1458.

Cost of, '80, 1438.

Brush mattresses. (See Dams,
Dikes, Jetties, Mattresses, and
Shore protection.)

Brush revetment. (See Shore pro-
tection.)

Cables for towing proposed on Dan
River, Va., '80, 788.

Canals.

1. *Description of.* 2. *Construction, as prism,
locks, water supply, etc.* 3. *Operation of,
as tolls and maintenance.*

1. DESCRIPTION.**Canals.**

- Description of proposed Albemarle and
Chesapeake*, '80, 867.
— Cascades of Columbia River, '81,
2563, 2567; '85, 2434.
— Chesapeake and Delaware, '80, 722;
'81, 571; '83, 725.
— Delaware and Maryland, '83, 755,
760.
— Hennepin, '83, 1754, 1788; '84, 1950;
'85, 2056; '86, 1733; '87, 2137.
— Dismal Swamp, '80, 867.
— Illinois and Michigan, '83, 175; '87,
2141, 2143.
— Maumee and Erie, '81, 2354.
— Portage Lake, Mich., '87, 1981.
— St. Mary's Falls, '82, 2358; '86, 1786,
1792.
— Santee, S. C., '81, 1149.
— Sturgeon Bay and Lake Michigan,
'87, 2024, 2030.
— Suez, '80, 985.
— Wabash and Erie, '81, 2363, 2413.

2. CONSTRUCTION.

- Requirements of ship canals, '81, 2576.
Determination of width, '82, 1239.
Locks, use of brick in construction of,
'81, 1312.
— thickness of floors, '86, 1258; '87,
1830.
— injury from expansion of cement,
'87, 1814.
— suggested improvements in construc-
tion of, '87, 1304.
— cost of stone work in, '87, 2434.
— description of Illinois River, '81,
2177; '85, 2054.
— — Muscle Shoals, '83, 1484, 1486;
'87, 1742.
— gate, appliance for operating, '87,
1742.
— — operated by steam, '80, 1730; '81,
1904.
— — snapended form for, '85, 1757.
Water supply at summit levels, '80, 871;
'81, 1152, 1890, 2402, 2410; '86,
1252.
— by pumps, '81, 1152.
— by filtration, '81, 571, 1152; '86,
1252.

3. OPERATION.

Tolls on Green River, '80, 1800.

— Louisville and Portland, '80, 172;
'82, 1907.

— Suez, '80, 985.

— compared with rail charges, '82,
2497; '86, 1944.

Canals—Continued.

Operation of Des Moines Rapids, '80,
1555; '81, 1731; '82, 1781; '83,
1406; '84, 1580; '85, 1700; '86,
1468; '87, 1644.

— Louisville and Portland, '80, 1724;
'81, 1904; '82, 1903; '83, 1533;
'84, 1692; '85, 1803; '86, 1574;
'87, 1843.

— St. Mary's Falls, '81, 2267; '82,
2355; '83, 1846; '84, 2016;
'85, 2108; '86, 1809; '87, 2227.

Cement, Hydraulic. (See also Concrete.)

Experiments to determine strength of,
'82, 2345; '83, 1848.

Effect of water on, '82, 2348.

— salt on, '82, 2350.

Mixing machine used on Illinois River,
'85, 2054.

Defective character of, at Muskingum
River, '85, 1823; '87, 1814.

Chanoine system of movable dams.
(See Dams.)**Chutes,** use of, in rivers, '81, 1935, 1943,
1980.**Clay formation** in valley of Mississippi
River, '83, 2315.**Coal.** Thickness of beds in Alabama,
'81, 1236.**Coffer-dams.** Plan of, at Rock Isl-
and Rapids, '86, 1450, 1461.

Advantage of gravelly-loam filling, '86,
1451.

Computing machines. Descrip-
tion of, '82, 2786.**Concrete.** (See also Cement, Hy-
draulic.)

Experiments to determine strength of,
'82, 2345; '83, 1849.

Effect of salt on, '82, 2348.

Use of, in breakwaters, '81, 2650, 2674;
'82, 2270; '87, 453, 504, 2353,
2364.

— dike construction proposed, '87, 972.

— jetty construction proposed, '80,
1126; '81, 1064; '82, 1480, 1486;
'87, 818.

— crib superstructure, '87, 2069, 2111,
2353, 2363.

— Washington Aqueduct, '87, 2547.

Failure of, in breakwaters, '81, 2674.

Cost of, '80, 1228.

Contract system compared with
hired labor, '82, 735.**Corporate work.** (See table at end
of Topical Index.)**Cost of work.**

Since the cost of work varies so largely
on account of location, competi-
tion, and previous experience,
only a limited number of refer-
ences are given. These will be
found for each work of improve-
ment under the subdivision of
Contracts in the Index of
Works.

Cresotting. (See Timber.)**Cribs.**

(See also Piers.)

1. Construction of. 2. Foundations for.
3. Cost.**1. CONSTRUCTION.**

Cribs, construction of, at lake harbors,
'81, 2153, 2158, 2164; '84, 1968;
'87, 2110.

Dove'ails, holding power of, '84, 2069.

Drift-bolts, holding power of, '84, 2051.

Most economic heights of, '87, 2407.

Spur-cribs at Oswego, N. Y., '84, 2148,
2150; '87, 2383.

Superstructure, average durability of,
'84, 2020; '87, 2111.

— parapet form for, '84, 2144; '85,
2279, 2307; '87, 2382.

— modified form proposed, '83, 1808.

— concrete proposed for, '87, 2060, 2111,
2353, 2363.

— cast-iron facing proposed, '87, 2060.

2. FOUNDATIONS.

Foundations, used at Milwaukee, '84,
1864.

— on piles, '82, 2321; '84, 1968, 1985.

— on stone, economy of, '82, 2321; '87,
2407.

— on mattresses, '82, 2321.

— displacement by ice, '87, 2058.

— settlement of, at Milwaukee, '84,
1865.

3. COST.

Cost of, at Ashtabula, Ohio, '80, 2165.

— Buffalo, N. Y., '80, 2202.

— Calumet, Ill., '80, 1989.

— Frankfort, Mich., '80, 2010.

— Grand Haven, Mich., '80, 2023.

— Ludington, Mich., '80, 2014.

— Manistee, Mich., '80, 2012.

— Menomonee, Mich., '80, 1904.

— Milwaukee, Wis., '87, 2059.

— Muskegon, Mich., '80, 2018.

— Ontonagon, Mich., '80, 1898.

— Pentwater, Mich., '80, 2015.

— St. Joseph, Mich., '80, 2032.

— Sand Beach, Mich., '80, 2076.

— Sturgeon Bay, Wis., '80, 1909.

— White River, Mich., '80, 2017.

Current meters. (See Surveys.)**Currents.** (See also Hydraulics.)

Velocity required to move different ma-
terial, '85, 570.

— necessity for high, '85, 569.

— methods of determining. (See Sur-
veys.)

— at Brazos, Santiago River, Tex., '81,
1353, 1368.

— — Lynn Harbor, Mass., '84, 546.

— — Newburyport, Mass., '81, 508.

— — Reedy Island, Del., '84, 820.

— — Sandy Hook, N. J., '85, 777, 784;
'86, 727, 740.

— — Yaquina Bay, Oreg., '87, 2468.

Currents—Continued.

Littoral, in Gulf of Mexico, '81, 1353, 1369.

— at Newburyport, Mass., '83, 437.

Relation between surface and sub-velocities. (See *Hydraulics*.) —

Dams.

1. *General considerations.* 2. *Reservoir dams.* 3. *Movable dams.* 4. *Brush and stone dams.*

1. GENERAL CONSIDERATIONS.

Dams, formulæ for height of, '87, 1305.

Height of swell on, '87, 1306.

Effect of exposure to air, '87, 2197.

2. RESERVOIR DAMS.

(See also *Reservoirs*.)

Reservoir dams at headwaters of Mississippi River, '81, 1763, 1765; '83, 1455, 1463, 1472, 1475; '85, 1748; '86, 1502; '87, 1677, 1675, 1686.

— on Potomac River, '84, 2321; '85, 2469, 2478, 2496.

— description of various, '82, 1830.

— action of, in improvement of rivers. (See *Reservoirs* and *Rivers*.)

— regulation of flow from, '85, 1848.

3. MOVABLE DAMS.

Movable dams, Chanoine system, '80, 682, 1737.

— Pasquean wickets, discussion of, '80, 1753.

— suggestions as to details of locks in, '87, 1304.

— maneuvering appliances for, '87, 1742.

— Bear trap system described, '85, 1862; '87, 1882.

— *Operation of*, on Great Kanawha River, '80, 682; '81, 913, 921, 927; '82, 921; '83, 711; '84, 932; '85, 1852; '86, 1594; '87, 1913.

— — Kentucky River, '84, 1733; '85, 1862, 1869, 1876; '87, 1882.

— — Ohio River, '85, 1785; '86, 1528, 1540; '87, 1786.

4. BRUSH AND STONE DAMS.

(See also *Dikes*, *Jetties*, and *Rivers*.)

Brush and stone dams described on Bayou Courtaubeu, '83, 1123.

— Columbia River, '87, 2513.

— Savannah River, '80, 934, 944, 1085; '82, 1168.

— Willamette River, '80, 2259, 2289.

— Wisconsin River, '80, 1962.

— — abandonment of system on, '87, 2096.

— Yellowstone River, '82, 1743.

— Yuba River, '81, 2492.

Dikes. (See also *Dams*, *Jetties*, and *Rivers*.)

Improvement of rivers by, '80, 1427; '85, 1576; '87, 2096, 2761.

Dikes—Continued.

Permeable, in construction, '80, 1365, 1405, 1427; '81, 1503, 1508, 1523, 1546, 1552, 1562, 1598, Plates X-XII, 1608, 1610, 1628; 1640, 1649, 1656; '82, 1499, 1601, 1611, 1635, 1678, 1681, 1685, 1690, 1696, 1699, 1702, 1707, 1722; '83, 1308, 1312, 1326, 1370, 2279, 2280, 2294, Plate III, Appendix L; '84, 2759, 2765, 2772, 2817, 2829, 2831, Plate II, Appendix J; Plate IV, Appendix L; '85, 2753, 2760, 2792; '87, 1560, 1564, 2760, 3098, 3099, 3112. (See also *Dikes* of piles and brush.)

— failure of, '87, 2761.

Of Brownlow-weeds, '80, 1433, 1454, 1458.

— hurdles, '85, 1657; '87, 1564. (See also *Dikes*, *Permeable*.)

— brush and stone, '80, 1542; '82, 1744; '85, 2378.

— piles and brush, '81, 1524, 1552; '82, 1707; '84, 2765, 2831; '85, 1570.

— crib work and stone, '80, 1738, 1740.

— concrete and timber, '87, 970.

Abandonment of plan of improvement by, on Wisconsin River, '87, 2076.

Discharge. (See also *Gauging* and *Hydraulics*.)

Of Atchafalaya River, '81, 1394, 1399.

— Connecticut River, '80, 405.

— Hudson River, '80, 482.

— Mississippi River, '83, 1459.

— Ohio River, '81, 1929.

— St. Croix River, '80, 1643.

— Wisconsin River, '81, 2137; '87, 2097.

Dredging. By use of propeller wheel, '80, 2016, 2019; '83, 1999; '85, 2380; '87, 2508.

By water-jet, '82, 1610; '83, 1238; '84, 1302; '85, 769.

Centrifugal pump, '85, 2331.

Hydraulic dredges, '81, 1086; '84, 1302; '85, 769, 928; '86, 684, 731, 739, 883; '87, 723, 886, 1611, 1614, 2345.

Transporting dredged material by chutes, '85, 928; '86, 883; '87, 886, 1614, 2345.

Cost of, '82, 734, 736. (See *Cost* of work.)

Drift-bolts. Holding power of, in timber, '84, 2031.

Drilling. (See *Rock removal*.)

Dry-dock. Plans for, at Sault Ste. Marie, '85, 2125.

Dovetails. Holding power of, in timber, '84, 2069.

Dynamite. (See *Explosives*.)

Evaporation. (See *Canals* and *Water*.)

Explosives. (See also *Rock removal*.)

Methods of testing, '81, 58; '83, 537, 1486.

Experiments with, at Hell Gate, '83, 537; '85, 724, 728.

Explosives—Continued.

- Sympathetic explosion of dynamite, '80, 57; '85, 725, 729, 733; '86, 686.
- Rack-a-rock*, constitution of, '85, 724; '86, 682.
- use of, at Hell Gate, '85, 716, 721, 724; '86, 680, 682, 683.
- Gun-cotton compared with dynamite, '81, 58.
- Corrosion of copper cases at Hell Gate, '86, 684.
- Methods used at Hell Gate, '86, 680, 686.
- Fuses used at Hell Gate, '86, 687.
- Batteries used at Hell Gate, '86, 687, 692.
- Waddington, N. Y., '82, 2466.
- Ratio between rock broken and explosives used, '80, 500; '81, 864; '83, 541; '86, 685.
- Fascines.** (See Mats.)
- Filtration** of water for domestic use, '80, 2361; '86, 2022, 2034.
- Fish.** Propagation of, '82, 552.
- Floods.** (See Rivers.)
- Foundations.** (See Breakwaters, Canals, Cribbs, and Piers.)
- Freight.** (See Transportation.)
- Gauges.** Construction of permanent, '83, 1313.
- Gauging rivers.** (See Surveys.)
- Grading banks.** (See Hydraulic grading.)
- Gulf of Mexico.** Littoral currents in, '81, 1353, 1369.
- Shoaling of area at mouth of Mississippi River, '80, 1134; '81, 1263; '82, 1329; '83, 1041; '84, 1243; '85, 1386; '86, 1235; '87, 1355.

Harbors.

1. *General considerations.* 2. *Harbors of refuge.* 3. *Improvement of harbors.*

1. GENERAL CONSIDERATIONS.

Harbors.

- Jurisdiction of, by the United States, '81, 742, 766, 844, 2422; '82, 2045; '83, 1696; '87, 724.
- Injury to, from artificial deposits, '80, 1773; '81, 1679, 2485; '83, 1696; '85, 1820; '86, 1092; '87, 724, 1983. (See also Rivers, injury to.)
- Anchorage area, determination of, '84, 579; '85, 531.

2. HARBORS OF REFUGE.

- Of refuge* from storms. (See in Index of Works, Harbors of refuge; also Delaware Breakwater, Grand Marais, New Haven, Sand Beach, and Sandy Bay harbors.)
- danger of parallel entrance piers, '80, 2021; '82, 2296.

Harbors—Continued.

- Of refuge*, advantage of exterior over interior, '82, 2295.
- *description of* Dublin, Ireland, '81, 1057.
- — Kurrachee, East Indies, '81, 1062.
- *from ice*, essentials of, on Mississippi River, '82, 1769.
- — iron barriers proposed in Delaware River, '82, 786; '85, 842.
- — floating pontoons proposed, '86, 834; '87, 804. (See also Harbors of refuge from ice in Index of Works.)

3. IMPROVEMENT OF HARBORS.

- Improvement of, by breakwaters.* (See Breakwaters.)
- dikes. (See Dikes.)
- dredging. (See Dredging.)
- jetties. (See Jetties.)
- piers. (See Piers.)
- rock removal. (See Rock removal.)
- Hurdle dikes.** (See Dikes.)
- Hydraulic dredges.** (See Dredges.)
- Hydraulic grading.** (See Shore protection and Water-jet.)
- Hydraulic mining.** Description of method, '82, 2546, 2551.
- Volume of water used, '82, 2611.
- Detritus furnished by, '82, 2556, 2620; '83, 2543.
- Effect on rivers, '81, 2485, 2494; '82, 2543, 2548; '83, 1690; '87, 1983.
- Grades of mining tunnels in California, '82, 5553.

Hydraulics. (See also Surveys.)

- Formulas* relating to, '82, 2481.
- for discharge, '83, 1349, 1359; '85, 2586.
- for mean velocity and slope, '82, 2480; '83, 1349; '86, 1302.
- for height of swell on dams, '87, 1306.
- waves, '87, 1965.
- Ratio of surface to mean velocity*, '85, 2580, 2597, 2613; '87, 1229.
- mid depth to mean velocity, '84, 1620; '87, 2706.
- Ice, formation of, in Allegheny River**, '80, 1771.
- Buffalo Harbor, '87, 2353.
- Delaware River, '81, 822; '82, 732, 959; '83, 744.
- Delaware and Chesapeake Canal, '82, 955.
- Upper Mississippi River, '84, 1620.
- Crushing strength of, '82, 786, 788.
- Pressure of, against piers, '82, 785; '87, 2076.
- Displacement of cribs by, '87, 2050, 2058.

Ice-boats, operations of, in Baltimore Harbor, '82, 956.

- Delaware River, '83, 600.

Ice harbors. (See Harbors.)

Iron deposits on Green River, Ky., '80, 1810.

Jet. (See Water-jet.)

Jetties.

(See also Dikes and Breakwaters.)

1. *Improvement of rivers and harbors by.*
2. *Classification as to methods of construction.*
3. *Miscellaneous.*

1. IMPROVEMENT OF RIVERS AND HARBOURS BY.**Jetties**, action of, in tidal rivers, '85, 681.

Effect of voids in, '82, 1434; '85, 681.

Improvement of Altamaha River by, '81, 1114.— *Baltic harbors by*, '81, 1060.— *Brunswick Harbor by*, '80, 961.— *Charleston Harbor by*, '80, 924; '83, 879; '86, 1069.— *Chippewa River by*, '83, 1440.— *Delaware River by*, '85, 824.— *Galveston Harbor by*, '80, 1228; '81, 1326; '82, 1444; '83, 1074.— *Holland rivers by*, '80, 1271.— *Mississippi River at South Pass.* (See Index of Works.)— *Newburyport Harbor by*, '81, 502; '83, 437.— *Pass Cavallo by*, '82, 1464.— *Pensacola Harbor by*, '81, 1179; '84, 1162.— *Sabine Pass by*, '83, 1043, 1052; '85, 1423.— *St. John's River by*, '85, 1251.— *Savannah Harbor by*, '81, 1101; '82, 1147; '83, 895, 907.— *Susquehanna River by*, '80, 596.— *Volusia Bar, Fla., by*, '82, 1201.**2. CLASSIFICATION OF JETTIES.**

Brush and stone, '80, 596, 922, 924, 964, 1228, 1271; '81, 502, 1044, 1052, 1061, 1101, 1114, 1179, 1328; '82, 1147, 1201, 1445, 1468; '83, 879, 895, 907, 1043, 1052, 1074, 1440; '84, 1162, 1163; '85, 824, 1251, 1423; '86, 1069.

Piles and stone, '83, 437, 584.*Gabions*, '80, 1203, 1222.— *failure of, at Galveston*, '86, 1295.*Concrete blocks*, '80, 1126.**2. MISCELLANEOUS.**

Cost of various forms, '80, 928; '81, 1067, 1123, 1132, 1356; '83, 658.

Scour along sides of, '82, 1196.*Shoaling at ends of*, '84, 1245.*Action of teredo on mats*, '82, 1188; '86, 1312.**Jurisdiction** of harbors and rivers.

(See Harbors.)

Kyan process for preserving timber.

(See Timber.)

Lakes. Northern and Northwestern.

Water level of, '80, 2636; '81, 2800; '82, 2344; '84, 2011; '86, 1844, '87, 1983, 2217, 2263, 2417.

Extreme oscillations of Lake Superior, '87, 1983.*Effect of deepening outlets to*, '82, 2470.**Levees.** Value of, in river improvement, '83, 2148.

Use of, in improvement of Mississippi River, '81, 2731, 2740; '82, 2753, 2766; '83, 2148; '84, 2422; '85, 1713, 2547, 2566, 2873; '87, 2766.

Section of, on Mississippi River, '84, 2863, 2866.

Closure of crevasses in, '84, 2866.

Protection against crawfish, '84, 2863.

Levels and leveling. (See Surveys.)**Locks.** (See Canals and Dams.)**Maps**, device for printing signs on, '85, 2898.**Mattresses.** (See also Dams, Dikes, Jetties, and Shore protection.)

Of brush described, '80, 938, 944, 1211, 1350, 1419; '81, 1044, 1328, 1504, 1507, 1560, 1598, Plate XV, 1610, 1614, 1639; '82, 1201, 1362, 1435, 1444, 1455, 1466, 1473, 1500, 1598, 1601, 1603, 1613, 1630, 1647; '83, 943, 1309, 1312, 1316, 1318, 1326; '84, 942; '85, 2988, Plates III, IV, and V; '87, 1387.

— *compression of*, '87, 1387.— *buoyancy of*, '80, 1211.*Wire net machine for*, '81, 1625, 1628, 1632.*Cane*, '80, 1146, 1210; '82, 1362.— *buoyancy of*, '80, 1211.— *cost of*, '80, 1146.*With attached wings*, '80, 1330; '87, 789.*Boat, described*, '80, 1419; '81, 1507, 1508.**Meters, Current.** (See Surveys.)**Mining, Hydraulic.** (See Hydraulic mining.)**Movable dams.** (See Dams.)**Nitro-glycerine.** (See Explosives)**Northern and Northwestern****Lakes.** (See Lakes.)**Pasquan wickets.** (See Dams, Movable.)**Photography**, results at explosion of Flood Rock, '86, 691, 716.**Piers.** (See also Crib.)

Occupation of, by private parties, '80,

2195; '85, 2255, 2257.

Foundations for. (See Crib.)

Parapet form of superstructure, '84,

2144; '85, 2279, 2307.

Careening of, at Marcus Hook, Pa., '83, 616.*Disadvantages of parallel*, '80, 2021;

'82, 2296.

Accumulation of shore drift at, '82, 582.*Scour at ends of*, '84, 1966.*Rendered sand-tight by brush*, '80, 1906.— *sheet-piling*, '80, 1906, 1914, 1916;

'81, 2078; '82, 2138.

Iron pier at Lewes, Del., '82, 782; '86, 838.— *proposed in Delaware Bay*, '82, 786; '85, 842.**Piles driving** methods discussed, '82,

1716; '83, 1145, 1249.

— *by steam hammer*, '83, 1185, 1270, 1272.

Piles—Continued.

- Driven by drop hammer*, '83, 1185.
- *water-jet*. (See *Water-jet*.)
- *various methods compared*, '83, 1185, 1249.
- *in sandy soils*, '83, 1249.
- *records of*, on Mississippi River, '84, 1505, 1519.
- *description of drivers on Mississippi River*, '82, 1719; '83, 1251.
- Sustaining power of*, '86, 1982; '87, 970.
- With square ends*, '80, 2251.
- Hollow cast-iron*, '80, 612; '82, 716; '85, 842.
- Cypress, durability of*, '83, 1132.
- Plan of, for soft bottom*, '87, 970.
- Brooming of, in driving*, '82, 2164.
- Lifting of, by ice*, '81, 618.
- Method of securing on rock bottom*, '82, 2137.

- Sheet, use of, in jetties*, '83, 437.
- Driven butt down*, '81, 1555.

Powder. (See *Explosives*.)

Puddle. Remarks on, '84, 2331.

Pumps. (See *Hydraulic dredges*.)

Rack-a-rock. (See *Explosives*.)

Railroads. (See *Transportation*.)

Rainfall. (See also *Canals, water supply for*.)

- Effect of forests upon*, '84, 662.
- Ratio of, to drainage*, '81, 1778.
- Amount on Columbia River*, '80, 2302.
- *Great Lakes*, '82, 2344.
- *Mississippi River, Upper*, '80, 1591, 1599, 1612; '81, 1778, 1801; '83, 1458, 1467; '84, 1622.
- *Basin*, '84, 1615, 1622.
- *Punta Rosa, Fla.*, '82, 1207, 1228.
- *St. Louis*, '84, 1615.
- *San Diego, Cal.*, '80, 2246.

Reservoirs. Improvement of rivers by, '80, 1590, 1601, 1659, 1952; '81, 1761, 1765, 1770, 1809, 2492, 2747; '83, 1455, 1463, 1472, 1475; '85, 1747; '86, 1502; '87, 1667, 1675, 1686.

Dams. (See *Dams*.)

- Regulation of discharge from*, '85, 1747.
- On Potomac River*, '84, 2321; '85, 2469, 2478, 2496.

Revetment to exclude sand from channels, '80, 1906, 1914, 1916; '81, 2078; '82, 2138.

Rivers.

1. *General considerations*. 2. *Physical characteristics, as banks, bed, floods, slopes, etc.* 3. *Improvement of*.

1. GENERAL CONSIDERATIONS.

Rivers, jurisdiction of United States on. (See *Harbors, jurisdiction of*.)

Injury to, from artificial deposits. (See *Harbors, injury to*.)

Bridging of. (See *Bridges*.)

2. PHYSICAL CHARACTERISTICS.

Banks, protection of. (See *Shore protection*.)

- *caving of, at Memphis*, '80, 1339.

Rivers—Continued.

Banks, caving of, on Red River of the North, '80, 1586.

- *on Sacramento River*, '80, 2238.
- *of gravel on Ohio River*, '85, 1840.
- Bars, origin of, in Mississippi River*, '83, 2373.

Bed, changes produced by ice, '80, 1771; '82, 695.

- *excessive depth of Potomac*, '83, 781.
- *sand-wave movement in*, '83, 2195, 2197, 2210, 2216, 2224, 2230; '85, 569; '87, 1351. (See also *Sand and Sediment*.)

Floods on, Connecticut, '80, 403.

- *Mississippi*, '80, 1560; '85, 2551, 2567.
- *Tennessee*, '80, 1670.

Discharge. (See *Hydraulics*.)

Slope. (See *Hydraulics*.)

3. IMPROVEMENT OF RIVERS.

Improvement of, by blasting. (See *Rock removal*.)

- *chutes*. (See *Chutes*.)
- *dams*. (See *Dams*.)
- *dikes*. (See *Dikes*.)
- *dredging*. (See *Dredging*.)
- *jetties*. (See *Jetties*.)
- *levees*. (See *Levees*.)
- *locks and canals*. (See *Canals*.)
- *reservoirs*. (See *Reservoirs*.)
- *rock removal*. (See *Rock removal*.)
- *scrows*. (See *Dredging*.)
- *shore protection*. (See *Shore protection*.)
- *slack-water navigation*. (See *Dams*.)
- *water-jet*. (See *Dredging and Water-jet*.)
- *wing-dams*. (See *Dams and Jetties*.)

Rock removal.

- From Ahucpee, Wis.*, '80, 1912; '83, 1680, 1681.
- *Columbia River*, '80, 2293, 2295; '83, 2051; '84, 2255; '85, 2436; '87, 2422.
- *Delaware River*, '81, 753; '83, 608.
- *Des Moines Rapids*, '80, 1556, 1557; '82, 1780.
- *Detroit River, Mich.*, '80, 2081; '81, 2277; '82, 2374; '85, 2166; '86, 1843; '87, 2267.
- *Georgetown Harbor, D. C.*, '84, 967.
- *Hell Gate, N. Y.*, '80, 499-504; '81, 621-628; '82, 651, 653; '83, 533-540; '85, 715-723; '86, 676-690; '87, 691.
- *James River*, '80, 650; '81, 863; '85, 951.
- *Narragansett Bay*, '81, 558.
- *New River, W. Va.*, '80, 681; '81, 908.
- *Portsmouth, N. H.*, '81, 501; '82, 505.
- *Red River*, '85, 1484.
- *Rock Island Rapids*, '80, 1536; '86, 1452-1461.
- *St. Mary's River, Mich.*, '85, 2103; '87, 2240.
- *Willamette, Oreg.*, '80, 2276-2288.
- Ratio of explosive to*, '80, 500; '81, 864; '83, 541; '86, 685.

Rock removal—Continued.

Ratio of solid to broken rock, '86, 685.

By use of coffer-dams, '85, 1753; '86, 1450, 1461. (See also Batteries and Explosives.)

Sand. (See also River Bars and Sediment.)

Specific gravity of, '80, 1504.

Waves, movement of, in river-beds, '81, 1579, 1653; '83, 2195, 2197, 2210, 2216, 2224, 2230; '85, 569; '87, 1351.

Deposition of, by meeting of salt and fresh water, '80, 953.

Mining, injury to rivers and harbors from. (See Harbors, injury to, and Hydraulic mining.)

Movement of, controlled by fences, '80, 2016; '81, 2211, 2236; '83, 475. (See also Shore protection.)

— at Sandy Hook, N. J., '82, 404.

Deposits at Dunkirk Harbor, France, '87, 2345.

Transportation of, by hydraulic dredges. (See Dredges.)

Pile driving in. (See Piles and Water-jet.)

Sawdust. *Injury to rivers from*, '81, 1679. (See also Harbors, injury to.)

Scows. *Description of self-dumping*, '85, 498.

Screw bolts. *Best form for*, '84, 1643; '85, 1758.

Sediment. (See also Sand.)

Method of determination, '87, 3090, 3121, 3123. Plates I, II, III, IV, and V.

Amount held in suspension, '81, 1653; '82, 2762; '83, 781; '86, 1249.

Ships. (See Vessels.)

Shore protection. *Most economical methods of*, '82, 1366, 1602, 1732.

By willow planting, '81, 1556; '82, 1595; '86, 1009.

— *sand fences*, '81, 2211, 2236; '83, 475.

— *mill edgings*, '80, 1580.

— *pile revetment filled with brush*, '80, 1839.

— *brush mattress revetment*, '80, 1275, 1335, 1339, 1389, 1408, 1412, 1417, 1420, 1422, 1427, 1436, 1440, 1442, 1444, 1459, 1496, 1506, 1586; '81, 1374, 1524, 1552, 1562, 1598, Plate XV, 1610, 1614, 1618, 1639; '82, 1500, 1598, 1601, 1613, 1613, 1688, 1690, 1694, 1700, 1732; '83, 1193-1243, 1308, 1312, 1317, 1326, 1440, 2294, Plate IV, Appendix L; '84, 2411, 2767, 2776, 2798, 2835, Plates VIII and IX, Appendix L; '85, 1566, 2776, 2795, 2950, 3026; '86, 1194, 1489; '87, 1558, 1565, 2734, 2761, 2765, 3109.

Grading banks by use of water-jet. (See Water-jet.)

Shore revetment. (See Shore protection.)

Sluices. *Flow of water through*, '80, 1621, 1623.

Use of, at Falls of St. Anthony, '80, 1565.

Transportation of sand by. (See Hydraulic dredges.)

For hydraulic mining. (See Hydraulic mining.)

Grade required for, '83, 1701.

Smags. (See also Index of Works, Mississippi River, Missouri River, and Ohio River.)

Dimensions of, '80, 1743; '85, 1793; '86, 1534.

Snag-boats. *Description of*, '80, 1838, 2234, 2284; '85, 1596; '87, 1555.

Soundings. (See Surveys.)

Standards of measurement. (See Surveys.)

Steam-boats. (See Vessels.)

Stone. *Specific gravities*, '80, 2264.

Crushing strength of, '80, 689.

Cost of. (See Index of Works, subdivision, Contracts.)

Surveys.

Base-line measurements at Jacksonville, Fla., '87, 1227.

— *use of steel tape for*, '87, 2943, 2952, 3124.

Triangulation methods on Missouri River, '83, 1334.

— *signals for*, '87, 1228.

Levels of precision, methods and results, '80, 2126; '83, 1335, 2175, 2289; '84, 2007, 2441, 2454, 2547, 2581; '85, 2650; '86, 1268; '87, 2945, 2949, 2981.

— *limit of allowable error in*, '87, 2981.

— *value of Wye level*, '87, 2981.

Current meters, description of, '80, 1219; '81, 1709.

— *rating of*, '81, 1709; '85, 2695; '87, 1227, 2522, 2836, 2841, 2848, 2856.

— *method of use on Mississippi River*, '80, 1518, 1523; '81, 1709; '83, 2226.

Soundings, method on Arkansas River, '85, 1609.

— *on Lake survey*, '85, 2103.

— *Mississippi River*, '80, 1517.

— *St. Mary's River*, '80, 2072; '86, 1803.

— *in swift currents*, '84, 2238.

— *rate at which lead line sinks*, '83, 2268.

Borings with water-jet, '81, 2049; '84, 617.

Maps, device for printing signs on, '85, 2898.

Teredo. (See also Timber.)

Piles covered with zinc protect against, '80, 1212.

Action of, on brush mats, '86, 1312.

— *on creosoted timber*, '81, 819; '82, 782.

Tides.

Observations at Annapolis Harbor, '81, 872, 874.

— *Atlantic City Harbor*, '81, 833; '87, 815.

Tides—Continued.

- Observations at Baltimore Harbor, '83, 685.*
- Calais, Me., '87, 478.
 - Cape Fear River, '80, 699, 706, 712; '81, 927, 940; '86, 997.
 - Columbia River, '81, 2539, 2550.
 - Connecticut River, '86, 626.
 - Delaware River and Bay, '80, 715, 730, 733; '81, 832.
 - Exeter Harbor, N. H., '81, 496; '82, 504.
 - Galveston Bay, '80, 1219; '86, 1300, 1316.
 - Hartford, Conn., '80, 404.
 - Hudson River, '85, 679.
 - Jacksonville, Fla., '87, 1229.
 - James River, '80, 650, 651; '81, 866, 896; '83, 685.
 - Jonesport, Me., '80, 361; '81, 461.
 - Nanticoke River, Md., '80, 731.
 - Nantucket Harbor, '80, 429; '85, 565.
 - Narragansett Bay, '81, 561.
 - Newburyport Harbor, '81, 501.
 - New York Harbor, '80, 532; '85, 777.
 - Potomac River, '83, 781.
 - Portland Harbor, Oreg., '87, 2507.
 - Providence Harbor, '80, 379, 387.
 - Rancocas River, N. J., '81, 798.
 - Saline Pass., Tex., '82, 1431; '86, 1280.
 - Savannah Harbor, '82, 1167.
 - Wood's Holl, Mass., '81, 546.

Timber.

- Best form for wooden beams, '83, 1486.
- Crocoated, '81, 690, 815, 818.*
- action of teredo on, '81, 818, 819; '82, 789.
 - amount of oil used, '81, 815, 818.
 - cost of, '81, 690; '84, 2145.
 - effect of, '81, 818.
 - use of, at Oswego, N. Y., '84, 2145; '85, 2278.
- Kyanized, '82, 2456.*
- cost of, '82, 2457.
 - strength of, '82, 2459.

Tows. Dimensions of, on Ohio River, '82, 1990.**Transportation.**

- Effect of river improvement on cost of, '87, 1921, 2116.
- Water and rail rates compared, '82, 2497; '87, 2129, 2130.

Tunnels. For Washington Aqueduct, '84, 2304; '85, 2453, 2469, 2480, 2496; '86, 2045; '87, 2537, 2547.**Vessels.**

- Dimensions of New York lines, '85, 781.
- Size of Ohio River coal tows, '84, 1685.
- Area required for anchorage of, '84, 579, 585; '85, 531.

Washington Aqueduct. (See Aqueducts.)**Water.**

- Supply for canals. (See Canals.)
- Evaporation of, in Florida, '82, 1207.
- Filtration of, '86, 2022, 2034.
- Analysis of, in Louisville Canal, '87, 1863.

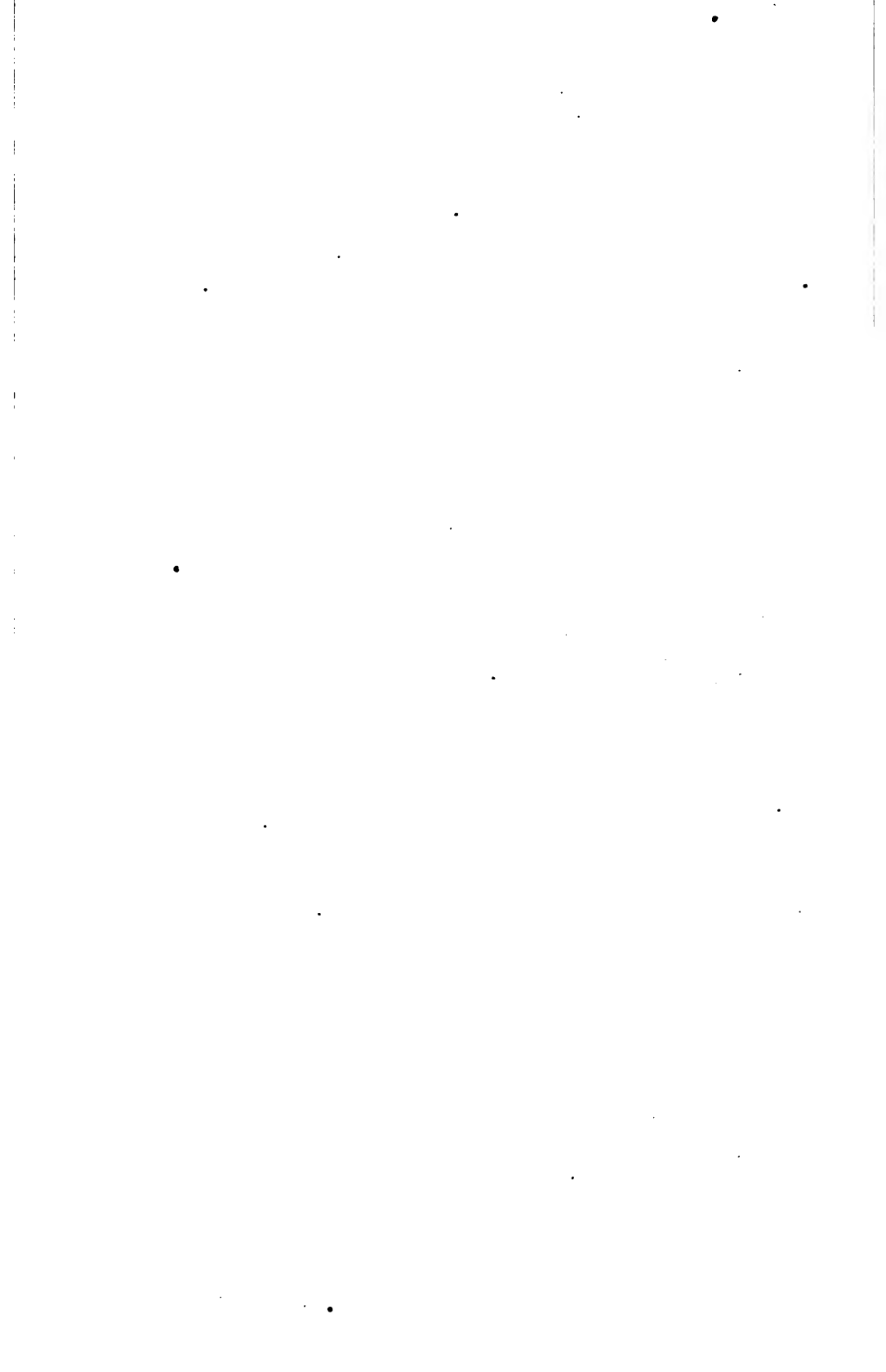
Water-jet.

- Use of, in grading banks for shore protection, '80, 1444-1448; '81, 1502, 1611; '82, 1504, 1576, 1685, 1688, 1691, 1701, 1715; '83, 1228, 1231, 1310, 1315, 1320, 1325, 2296; '84, 2765, 2760, 2799, 2801, 2836; '85, 2775, 2949; '87, 2915.*
- driving piles, '80, 1912; '81, 1508, 1554, 1621; '82, 1607, 1677, 1711, 1719, 1723; '83, 1185, 1249, 1270, 1280, 1292; '84, 2770, 2832; '85, 2384; '86, 1981; '87, 3100.
 - deepening channels, '82, 1595, 1610; '83, 1238; '84, 1302; '85, 769.
 - making borings, '81, 2049; '84, 617.
 - cleaning rock of detritus, '81, 657, 2507. (See also Hydraulic mining.)

Waves.

- Height of, on Lake Superior, '87, 1965.*
- at Sandy Hook, '81, 678.
 - on Lake Erie, '85, 2279.
 - formula for, '87, 1965.
- Velocity of, '81, 683; '85, 2279.
- Force at Oswego, N. Y., '81, 2635; '85, 2279.
- Action of, on bars, '81, 676-685; '82, 585.
- Slopes on breakwaters from, '84, 572.
- Of sand. (See Sand.)
- Through earth at explosion of Flood Rock, '86, 690, 694, 705, 712.

Willows for shore protection, '85, 1556; '82, 1595; '86, 1009.**Wing-dams.** (See Dams and Jetties.)**Wire netting.** (See Dikes, Mattresses, and Shore protection.)**Wooden beams.** (See Beams.)**Wrecks,** on Pacific coast, '81, 2636, 2684. (See also Index of Works, subject, "Wrecks.")



PERSONAL INDEX.

Containing the names of contractors and civil employees who are mentioned in the reports, with references to the title in the Main Index of each work upon which they were engaged. Full references for each name will be found in the Main Index.

[Continued from Vol. I, pp. 603-624.]

ABERT, S. T., *U. S. Agent.*

Aquia Creek, Va.
Breton Bay, Md.
Chickahominy River, Va.
Chickamuxen Creek, Md.
Colonial Beach, Va.
Currioman Bay, Va.
Dan River, Va. and N. C.
French Broad River, N. C.
Hampton River, Va.
Hull's Creek, Va.
Hunter's Creek, Va.
Leonardtown Harbor, Md.
Mattaponi River, Va.
Mattox Creek, Va.
Neabasco Creek, Va.
Nomini Creek, Va.
Occoquan River, Va.
Pamunky River, Va.
Patuxent River, Md.
Piankatank River, Va.
Piscataway Creek, Md. and Va.
Port Tobacco Creek, Md.
Potomac and Anacostia rivers, Va.
Potomac River at Mount Vernon.
Quantico Creek, Va.
Rappahannock River, Va.
Roanoke River, N. C.
St. Jerome's Creek, Md.
Staunton River, Va.
Staunton River between Brook Neal and mouth of Pig River.
Totusky River, Va.
Upper Machodoc and Urbana creeks.
Urbana Creek, Va.
Washington and Georgetown Harbors, D. C.
Wicomico River (Great), Va.
Yadkin River, N. C.
York River, Va.

ABRAHAM. (See KIRK & ABRAHAM.)

ADAMS, G. W., *Contractor.*

Pensacola Harbor, Fla.

ADAMS, T. P., *Assistant Engineer.*

Arkansas River at Pine Bluff, Ark.

AINSLIE, COCHRAN & Co., *Contractors.*

Kanawha River (Great), W. Va.

AINSWORTH, G. J., *Contractor.*

Columbia River (Upper) and Snake River.

ALEXANDER, G., *Assistant Engineer.*

Warren River, R. I.

ALEXANDER, W. A., *Contractor.*

Apalachicola Bay, Fla.
Escambia and Conecuh rivers, Ala. and Fla.

ALLEN & BLAISDELL, *Contractors.*

Ohio River (except Falls, etc.).

Red River, La. and Ark.

ALLEN, J. W., *Assistant Engineer.*

Fox and Wisconsin rivers.

ALLEN, L. E., *Contractor.*

Charlevoix Harbor, Mich.

Frankfort Harbör, Mich.

ALLEN, T. J., *Contractor.*

New Haven, Conn.

ALLMENDINGER, J. M., *Contractor.*

St. Joseph Harbor, Mich.

ALMY, G. C., *Assistant Engineer.*

Stonington Harbor, Conn.

ALRICHS, H., *Assistant Engineer.*

Susquehanna River, Pa.

AMBROSE, J. W., *Contractor.*

Gowanus Bay, N. Y.

AMERICAN DREDGING COMPANY, *Contractors.*

Annapolis Harbor, Md.

Baltimore Harbor, Md.

Broadkill River, Del.

Corsica Creek, Md.

Delaware Bay, ice-harbor at head of.

Delaware River below Bridesburg.

Duck Creek, Del.

Frankford Creek, Pa.

Marcus Hook, Del.

Maurico River, N. J.

Mispillion Creek, Del.

New Castle, Del.

Onancock Harbor, Va.

Potomac River, Washington, D. C.

Rancocas River, N. J.

St. Jones River, Del.

Salem River, N. J.

Savannah River at and below Augusta.

Schuylkill River, Pa.

Secretary Creek, Md.

Susquehanna River at and below Havre de Grace.

Treadhaven Creek, Md.

Wilmington Harbor, Del.

York River, Va.

ANDERSON & BLAISDELL, *Contractors.*

Volusia Bar, Fla.

Savannah River above Augusta.

ANDERSON, C. D., *Assistant Engineer*.
 Homochitto River, Miss.
 Natalbany River, La.

ANDREWS, G. W., *Contractor*.
 Saco River (breakwa'er), Me.

ANDREWS, J., *Contractor*.
 Gut opposite Bath, Me.
 Merrimac River, Mass.
 Portsmouth Harbor, N. H.

ANDREWS & LOCKE, *Contractors*.
 Delaware Breakwater, Del.

APPLETON, C. H., *Contractor*.
 Mississippi River, St. Paul to Des Moines Rapids.

ARNOLD & STEVENS, *Contractors*.
 New Haven, Conn.

ATKINSON, J. J., *Contractor*.
 Buffalo Bayou, Tex.
 Muity River, Tex.

ATLANTIC DREDGING COMPANY, *Contractors*.
 East River, N. Y.
 Keyport Harbor, N. J.
 Lubec Channel, Me.
 Newtown Creek, N. J.
 Providence River and Narragansett Bay, R. I.
 Raritan Bay, N. J.
 Sheepshead Bay, N. Y.
 Wareham Harbor, Mass.

ATLAS DREDGING COMPANY, *Contractors*.
 Cape Fear River, N. C.

AVEHILL, D. M., *Contractor*.
 Fairport Harbor, Ohio.

BABCOCK, H. N., *Assistant Engineer*.
 Ashland Harbor, Wis.
 Black Rock Harbor, Conn.
 Branford Harbor, Conn.
 Clinton Harbor, Conn.
 Greenport Harbor, N. Y.
 Madison Harbor, Conn.
 Mamaroneck Harbor, N. Y.
 Milford Harbor, Conn.
 Peconic River, N. Y.
 Stamford Harbor, Conn.
 Westport Harbor, Mass.

BACON. (See BRODERICK & BACON.)

BACON, H., *Assistant Engineer*.
 Cape Fear River, N. C., below Wilmington.
 Chester River, Md.

BACON, J. H., *Assistant Engineer*.
 Lockwoods Folly River, N. C.

BAGNALL, G., *Assistant Engineer*.
 Mississippi River, between mouths of Illinois and Ohio rivers.

BAILEY, D. E., *Contractor*.
 Buffalo Harbor, N. Y.

BAKER, S. S., *Contractor*.
 Duluth Harbor, Minn.
 Grand Marais Harbor of Refuge, Mich.
 Withlacoochee River, Fla.

BAKER, W. H., *Contractor*.
 Pensacola Harbor, Fla.

BALLOU, F. K., *Contractor*.
 New Haven, Conn.
 Stonington Harbor, Conn.
 Thames River, Conn.

BALTIMORE DREDGING COMPANY, *Contractors*.
 Corsica River, Md.

BALTIMORE DREDGING COMPANY—C't'd.
 Susquehanna River at and below Havre de Grace.

BANGS, A. M., *Contractor*.
 Charleston Harbor, S. C.

BANGS & DOLBY, *Contractors*.
 Charleston Harbor, S. C.

BANGS, E. T., *Contractor*.
 Charleston Harbor at Sullivan's Island, S. C.
 Savannah River at and below Augusta.

BANGS, M., *Contractor*.
 Savannah River at and below Augusta.

BARBER, A. W., *Assistant Engineer*.
 Anclote Harbor, Fla.
 St. Augustine Harbor, Fla.
 St. John's River to Juniper Inlet, Fla.
 Volusia Bar, Fla.

BARBER, W. H., *Assistant Engineer*.
 Apalachicola Bay, Fla.

BARKER, C. S., *Contractor*.
 Alpena Harbor (Thunder Bay), Mich.
 St. Mary's River and Falls Canal, Mich.
 Superior Bay and St. Louis Bay, Wis.

BARNETT, J., *Contractor*.
 Ashtabula Harbor, Ohio.
 Erie (Presque Isle) Harbor, Pa.

BARNEY, J. H., *Assistant Engineer*.
 Coldwater River, Miss.

BARRETT. (See MCKENZIE & BARRETT.)

BARRET, J., *Contractor*.
 Cleveland Harbor, Ohio.

BARRY, J. J., *Assistant Engineer*.
 Big Hatchie River, Tenn.
 Big Sunflower River, Miss.
 Coldwater River, Miss.
 Deer River (South Forked), Tenn.

BAYLESS, S. L., *Assistant Engineer*.
 Beaver Bay, Minn.

BAY STATE DREDGING COMPANY, *Contractors*.
 Boston Harbor, Mass.

BEAMEN, I. W., *Assistant Engineer*.
 Red River, La. and Ark.

BEARDSLEY, A. J. & H. N., *Contractors*.
 Bridgeport Harbor, Conn.
 Flushing Bay, N. Y.
 New Haven Harbor, Conn.
 Newtown Creek, N. Y.
 Norwalk Harbor, Conn.
 Pawcatuck River, R. I. and Conn.
 Sheepshead Bay, N. Y.

BEARD, W. H., *Contractor*.
 Narragansett Bay (Little), R. I. and Conn.
 Providence River, R. I.
 Taunton River, Mass.

BEATTIE, J., *Contractor*.
 Connecticut River below Hartford, Conn.
 New Haven, Conn.
 Port Jefferson Harbor, N. Y.

BECKFORD, KNOX & CO., *Contractors*.
 Chicago Harbor, Ill.

BEDFORD, S., *Contractor*.
 Saugatuck Harbor, Mich.
 White River Harbor, Mich.

BELFORD, S., *Contractor*.
 Manistee Harbor, Mich.

BELL, A. C., *Assistant Engineer*.
 Calcasieu Pass, La.

- BELL, D., *Contractor*.
Sand Beach, Mich.
- BENNERMAN. (See KELLY & BENNERMAN.)
- BENNETT, J., *Contractor*.
Fairport Harbor, Ohio.
- BENNETT, R. S., *Assistant Superintendent*.
Kentucky River, Ky.
- BENSON & MCNEE, *Contractors*.
Potomac River, D. C.
- BENTLEY, H. A., *Assistant Engineer*.
Pawtucket River, R. I.
Potowomut River, R. I.
Providence River and Narragansett Bay.
- BENTON. (See BRAINARD & BENTON.)
- BENTON, T. H., *Contractor*.
Elizabeth River, N. J.
- BURGESS. (See SHUMWAY, BURGESS & Co.)
- BERNER. (See SCHWARZ & BERNER.)
- BERRER, C., *Assistant Engineer*.
Saco River, Me.
York Harbor, Me.
- BIETRY. (See GERVIN & BIETRY.)
- BIRCH, H., *Contractor*.
Nomini Creek, Va.
Rappahannock River, Va.
- BIRD, C. M., *Assistant Engineer*.
Chincoteague Bay to Delaware Bay.
Pocomoke River, Md.
Sassafras River, Md.
- BIRD, H. D., *Assistant Engineer*.
Appomattox River, Va.
- BLACK. (See HARRIS & BLACK.)
- BLAISDELL. (See ALLEN & BLAISDELL.)
- BLAISDELL, A. H., *Assistant Engineer*.
Missouri River from mouth to Fort Benton.
- BLAISDELL & ANDERSON, *Contractors*.
Savannah River above Augusta.
Volusia Bar, Fla.
- BLANCHARD & MCALPINE, *Contractors*.
Sand Beach, Mich.
- BLUNDON. (See THOMAS & BLUNDON.)
- BLUNT, W. G., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- BOALT. (See McDONALD & BOALT.)
- BODWELL GRANITE COMPANY, *Contractors*.
Rockland Harbor, Me.
- BOSCHKE, A., *Assistant Engineer*.
Humboldt Bay Harbor, Cal.
Sacramento and Feather rivers, Cal.
Smith's River, Cal.
Wilmington Harbor, Cal.
- BOTH, A. C., *Assistant Engineer*.
Harriseeket River, Me.
Moosebec River at Jonesport, Me.
Narragausus River, Me.
- BOTHFIELD, H. F., *Assistant Engineer*.
Boston Harbor, Mass.
Gloucester Harbor, Mass.
Hingham Harbor, Mass.
Hull Harbor, Mass.
Lynn Harbor, Mass.
- BOUKER, J. A., *Contractor*.
Black Rock Harbor, Conn.
- BOUKER, J. A.—Continued.
Nantucket Harbor, Mass.
New Haven Harbor, Conn.
Shrewsbury River, N. J.
Stonington Harbor, Conn.
Thames River, Conn.
- BOYD. (See SHADBOLT, BOYD & Co.)
- BOYNTON BROTHERS, *Contractors*.
Hingham Harbor, Mass.
Scituate Harbor, Mass.
- BRADY, J., *Contractor*.
Brunswick Harbor, Ga.
- BRAGDON, C. H., *Contractor*.
Richmond Island, Me.
- BRAINARD & BENTON, *Contractors*.
Pawtucket River, R. I.
Staten Island and New Jersey Channel.
- BRAINARD, E., *Contractor*.
Black Rock Harbor, Conn.
Canarsie Bay, N. Y.
Gowanus Bay, N. Y.
New London Harbor, Conn.
New York Harbor (Gedneys and Main Ship-Channel).
Passaic River, N. J., below Newark.
Pawtucket River, R. I.
Shrewsbury River, N. J.
Woodbridge Creek, N. J.
- BRETHERTON, A. S., *Contractor*.
Ontonagon Harbor, Mich.
- BRIDGEWATER IRON AND STEEL COMPANY, *Contractors*.
Sandy Bay, Mass.
- BROADLEY, T. C., *Assistant Engineer*.
Missouri River from mouth to Sioux City.
- BROCK, F. A., *Contractor*.
Brazos River, Tex.
- BRODE ICK & BACON, *Contractors*.
Mississippi River, between mouths of Illinois and Ohio rivers.
- BROOKS, JOSLYN & Co., *Contractors*.
Sand Beach, Mich.
- BRONDWAY. (See WOOLEN & BRONDWAY.)
- BROWN, C. A., *Contractor*.
Delaware Breakwater, Del.
- BROWN, E. G., *Contractor*.
Elizabeth River, N. J.
Railway River, N. J.
- BROWN, H. S., *Contractor*.
Galena River and Harbor, Ill.
Mississippi River, from Des Moines Rapids to mouth of Illinois River.
- BROWN, H. S., & Co., *Contractors*.
Cnivre River, Mo.
Mississippi River, from St. Paul to Des Moines Rapids.
- BROWN, W. H., *Contractor*.
Delaware Breakwater, Del.
Savannah River above Augusta.
- BRUNNER, F., *Contractor*.
Aransas Pass and Bay, Tex.
- BRYAN, J. A., *Contractor*.
St. John's River, Fla.
Volusia Bar, Fla.
- BUCHANAN, J. C., *Assistant Engineer*.
Bayon and Pass Manchac, La.
- BURGER. (See RAND & BURGER.)

- BURGWYN, C. P. E., *Assistant Engineer*.
James River, Va.
- BURKE, W. H., *Assistant Engineer*.
Galveston Harbor, Tex.
- BURNET & Co., *Contractor*.
Falls of Ohio River.
- BURNETT & ROSS, *Contractor*.
Galveston Harbor, Tex.
- BURNETT, R. S., *Contractor*.
Altamaha River, Ga.
- BURNEY, J., *Assistant Engineer*.
Bayou Pierre, La.
Big Hatchie River, Tenn.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- BURROWS, F. S., *Assistant Engineer*.
Bayou l'Arbonne, La.
Bayou Macon, La.
Belamy River, N. H.
Cassidy's Bayou, Miss.
Cypress Bayou, Tex.
Deer Creek, Miss.
Mississippi River, between mouth of
Ohio River and Head of Passes.
Monroe Harbor, La.
Ouachita and Black rivers, La. and Ark.
Red River, La.
- BYRAM, W. H., *Assistant Engineer*.
Arkansas River at Pine Bluff, Ark.
- BYRNES. (See HITCHCOCK & BYRNES.)
- CACKEY. (See STUBBS & CACKEY.)
- CAFFEY, O. N., *Assistant Engineer*.
Mississippi River, from Des Moines
Rapids to mouth of Illinois River.
- CALDWELL, J., *Contractor*.
Ashtabula Harbor, Ohio.
- CALER, J., *Contractor*.
Chickahominy River, Va.
James River, Va.
- CALER, J., & Co., *Contractors*.
Archers Hope River, Va.
Currituck Sound, Coanok Bay, and
North River Bar, N. C.
James River, Va.
Pagan Creek, Va.
St. Jeromes Creek, Md.
- CALUMET AND CHICAGO CANAL AND DOCK
COMPANY, *Contractors*.
Calumet Harbor, Ill.
- CANADA. (See MOSELY & CANADA.)
- CANADY, B. W., *Contractor*.
Neuse River, N. C.
- CARKIN, STICKNEY & CRAM, *Contractors*.
Ashtabula Harbor, Ohio.
Au Sable River and Harbor, Mich.
Belle River, Mich.
Cheboygan Harbor, Mich.
Clinton River, Mich.
Detroit River, Mich.
Manistee Harbor, Mich.
Portage Lake, Mich.
Saginaw River, Mich.
St. Mary's River and Falls Canal.
Sandusky City Harbor, Ohio.
Toledo Harbor, Ohio.
- CARMODY. (See SHIPMAN & CARMODY.)
- CARMODY & MAPLE, *Contractors*.
Wabash River, Ind.
- CARPENTER, E. J., *Assistant Engineer*.
Middleport Harbor, Ohio.
- CARPENTER, E. J.—Continued.
Ohio River (except Falls, etc.).
Ohio River at Rochester, etc.
- CARREL, F. J., *Assistant Engineer*.
Snake River, Wash.
- CARRUTHERS, T. H., *Contractor*.
Kentucky River, Ky.
- CARSON, J. P., *Assistant Engineer*.
Broad River, S. C.
- CARY, J. L., *Assistant Engineer*.
Tennessee River at and below Chat-
ta-nooga.
- CASE, J. H., *Contractor*.
Oswego, N. Y.
- CASGRAIN, W. T., *Contractor*.
Ontonagon Harbor, Mich.
Sheboygan Harbor, Wis.
- CASHEN, MCKAY & Co., *Contractors*.
Skagit, Stielaquamish, and Nootsack
rivers, Wash.
- CATE, C. E., *Contractor*.
Tangipahoa River, La.
- CHALMERS. (See HOLMES & CHALMERS.)
- CHAMBERLAIN, W., *Contractor*.
Rahway River, N. J.
- CHANDLER BROTHERS, *Contractors*.
St. Clair Flats, Mich.
- CHAPMAN, A. F., *Contractor*.
Sodus Harbor (Great), N. Y.
- CHAPMAN, J. E., *Contractor*.
Boston Harbor, Mass.
Portland Harbor, Me.
- CHARLESTON DREDGING COMPANY, *Con-
tractors*.
Ashley River, S. C.
Wappoo Cut, S. C.
- CHASE, E. A., *Assistant Engineer*.
Big Sandy River, W. Va. and Ky.
Guyandotte River, W. Va.
- CHENEY. (See TRUMBULL & CHENEY.)
- CHICAGO DOCK AND DREDGING COMPANY,
Contractors.
Calumet Harbor, Ill.
Chicago Harbor, Ill.
- CHICAGO LUMBERING COMPANY, *Con-
tractors*.
Manistique Harbor, Mich.
- CHILDS, W. M., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- CHURCH, D. W., *Assistant Engineer*.
Missouri River, from mouth to Sioux
City.
- CHURCHILL, J. C., *Assistant Engineer*.
Lake Champlain Channel, etc.
Waddington Harbor, N. Y.
- CINCINNATI IRON COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- CLARK, D. A., *Assistant Engineer*.
Ohio River (except Falls, etc.).
- CLARK, J., *Contractor*.
Ohio River (except Falls, etc.).
- CLAYBROOKE, J. P., *Assistant Engineer*.
Ohio River, Falls of.
- CLEARY, J., *Contractor*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- CLENDINEN & GRAHAM, *Contractors*.
Ohio River (except Falls, etc.).
- CLEVELAND, BROWN & Co., *Contractors*.

- CLEVELAND, BROWN & Co.—Continued.
Ashtabula Harbor, Ohio.
Erie (Presque Isle) Harbor, Pa.
Port Clinton Harbor, Ohio.
- CLOUD, J. A., *Contractor*.
St. John's River and Fernandina Harbor, Fla.
- COCHRAN. (See AINSLIE, COCHRAN & Co.)
- CODD, E. J., & Co., *Contractors*.
Norfolk Harbor, Va.
- COLE, C. M., *Contractor*.
Mississippi River, from Des Moines Rapids to mouth of Illinois River.
Ohio River (except Falls, etc.).
- COOK, J. W., *Contractor*.
Ohio River (except Falls, etc.).
- COOLEY, L. E., *Assistant Engineer*.
Missouri River, from mouth to Sioux City.
- COLLINS, H. C., *Assistant Engineer*.
Amite River, La.
Bayou Chito River, Miss. and La.
Bayou Courtableau, La.
Bayou Falia River, La.
Bayou Teche, La.
Bayou Fusillier, La.
Carthage and Jackson harbors.
Cashie River, N. C.
Grand Lake, La.
Natalbany River, La.
New Orleans, La.
Tangipahoa River, La.
Tchefuncte River, La.
Tickfaw River, La.
Water courses in Louisiana.
West Pearl River, La.
- COLORADO AND SANTA FÉ RAILROAD, *Contractors*.
Galveston Harbor, Tex.
- CONGLETON, T. J., & BROTHER, *Contractors*.
Kentucky River, Ky.
- CONLEY, O. J., *Contractor*.
New Haven Harbor, Conn.
- CONSTANTINE, D., *Contractor*.
Chester River, Md.
Choptank River, Md.
James River, Va.
Onancock Harbor, Va.
Pocomoke River, Md.
St. Jerome's Creek, Md.
Urbaná Creek, Va.
- COON & MOONEY, *Contractors*.
Susquehanna River, Pa.
- COOPER. (See TRUMAN & COOPER.)
- CORLETT. (See DEWAR & CORLETT.)
- CORLETT, J., *Contractor*.
Pentwater Harbor, Mich.
White River Harbor, Mich.
- CORNWELL, C. L., *Assistant Engineer*.
Ohio River, Falls of.
- COTTON, F. B., *Contractor*.
Delaware River below Bridesburg.
- COTTON, J. P., *Assistant Engineer*.
Block Island Harbor, R. I.
Taunton River, Mass.
Wareham Harbor, Mass.
Wood's Holl Harbor, Mass.
- COVINGTON DOCK COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- COX, J. J., *Contractor*.
Kentucky River, Ky.
- COYNE, J., *Contractor*.
Ohio River (except Falls, etc.).
- CRAIG, N. B., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- CRAWFORD, H., *Contractor*.
Kanawha River (Great), W. Va.
- CRESCENT CITY WRCKING COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- CROSMAN, C., *Assistant Engineer*.
Abnapee Harbor, Wis.
Menomonee Harbor, Mich. and Wis.
- CROZER, W. C., *Assistant Engineer*.
Cumberland River (above Nashville).
Cumberland River, Ky.
- CULBERT BROTHERS, *Contractors*.
Calumet Harbor, Ill.
- CULPEPPER, H. E., *Contractor*.
Chickahominy River, Va.
Pagan Creek, Va.
- CULVER, D. E., *Contractor*.
Potomac River, D. C.
- CUMMINGS. (See MORRIS & CUMMINGS.)
- CUMMINGS, S. R., *Contractor*.
Cheesequakes Creek, N. J.
Delaware Breakwater, Del.
- CUMMINGS, T., *Contractor*.
Wilmington Harbor, Del.
- CUNNINGHAM, L. A., *Contractor*.
Volusia Bar, Fla.
- CURRIE, C., *Contractor*.
Sand Beach, Mich.
- CURRIE, D. M., *Assistant Engineer*.
Mississippi River, between mouths of Illinois and Ohio rivers.
- CURRITT, J. F., *Contractor*.
Portsmouth Harbor, N. H.
- CURTIS, W. K., *Assistant Engineer*.
Brunswick Harbor, Ga.
Cumberland Sound, Fla. and Ga.
- CUTLER & SAVIDGE, *Contractors*.
Grand Haven Harbor, Mich.
- DABNEY, T. J., *Assistant Engineer*.
Mississippi River, between mouth of Ohio and Head of Passes.
- DAGER, J. H., *Assistant Engineer*.
Brandywine River, Del.
Delaware River.
Wilmington Harbor, Del.
Susquehanna River, Pa.
- DAGGETT, T. W., *Contractor*.
Waccamaw River, N. C.
- DAKE, D., *Contractor*.
Frankfort Harbor, Mich.
- DALE, H. S., *Contractor*.
Frankfort Harbor, Mich.
Grand Haven Harbor, Mich.
Manistee Harbor, Mich.
- DALY. (See McDERMOTT & DALY.)
- DALY, C., *Contractor*.
Waddington Harbor, N. Y.
- DALY, W. J., *Contractor*.
Sackett's Harbor, N. Y.
- DARLING, J. P., *Assistant Engineer*.
Beaufort Harbor and New River, N. C.
Cape Fear and Waccamaw rivers, N. C.
Lillington River, N. C.

DARLING, J. P.—Continued.

Lynch's River, S. C.
 New Berne to Beaufort, N. C.
 New River, N. C.
 Pamlico and Tar River, N. C.
 Town Creek, N. C.
 Wateree River, S. C.
 White Oak River, N. C.
DARRAH. (See **WALTER & DARRAH.**)
DAUBENEY, G., Assistant Engineer.
 Atlantic City Harbor, N. J.
 Cumberland Sound, Fla and Ga.
 Port Royal River, S. C.
D'AURIA, L., Assistant Engineer.
 Atlantic City Harbor, N. J.
DAVENPORT, R., Assistant Engineer.
 Cannon River, Minn.
 Minnesota River, Minn.
 Mississippi River, reservoir at sources.
 Mississippi River, above Falls of St. Anthony.
 Red Lake River, Minn.
 Red River of the North, Minnesota and Dakota.
DAVIDSON, P. S., Contractor.
 Mississippi River, St. Paul to Des Moines Rapids.
DAVIS, B. A., Contractor.
 Appomattox River, Va.
DAVIS, C. B., Assistant Engineer.
 Missouri River, from mouth to Sioux City.
DAVIS, C. E., Contractor.
 Hyannis Harbor (breakwater), Mass.
 Wood's Holl Harbor, Mass.
DAVIS, F. S., Assistant Engineer.
 Mississippi River, between mouth of Ohio River and Head of Passes.
DAVIS, J. C. & J. H., Contractors.
 Sandusky City Harbor, Ohio.
DAVIS, J. H., Assistant Engineer.
 Mississippi River, between mouth of Ohio River and Head of Passes.
DAVIS, N. S., Assistant Engineer.
 Calcasieu River, La.
 Yalabusha River, Miss.
DAVIS, S. D., Contractor.
 Ohio River (except Falls, etc.).
DAVIS, S. H., Contractor.
 Sacramento and Feather rivers, Cal.
DAVIS, W. S., Assistant Engineer.
 Bear Creek, Miss. (branch of Yuzoo River).
 Big Black River, Miss.
 Loosascoona River, Miss.
 Roebuck Lake, Miss.
 Tchula Lake, Miss.
DAWES, IRISH & CO., Contractors.
 Muskingum River, Ohio.
DE COTTES, G. A., Contractor.
 Volusia Bay, Fla.
DE LANO, C. H., Contractor.
 Ticonderoga River, N. Y.
DELAWARE AND CHESAPEAKE IMPROVEMENT COMPANY, Contractors.
 Delaware River below Bridesburg.
 Wilmington Harbor, Del.
 York River, Va.
DEMING & OLIVER, Contractors.
 St. Joseph Harbor, Mich.

DENIS, G., Contractor.

Green Bay Harbor, Wis.
 Oconto Harbor, Wis.
DENNIS, C. T., Contractor.
 Fairport Harbor, Ohio.
DENNIS, J. W., Contractor.
 Charlotte Harbor, N. Y.
 Conneaut Harbor, Mich.
 Grand Haven Harbor, Mich.
 Milwaukee Bay, Wis.
 Muskegon Harbor, Mich.
DEVEREUX, N. A., Contractor.
 Charleston Harbor, S. C.
DEWAR & CORLETT, Contractors.
 Ludington Harbor, Mich.
 Muskegon Harbor, Mich.
 St. Joseph Harbor, Mich.
DEWAR, D., Contractor.
 Ludington Harbor, Mich.
 Manistee Harbor, Mich.
DEWAR & WING, Contractors.
 Black Lake Harbor, Mich.
 Frankfort Harbor, Mich.
 Manistee Harbor, Mich.
DICKERSON & PAULSON, Contractors.
 Romerly Marsh, Ga.
 Savannah River at and below Augusta.
DILLABECK & MURPHY, Contractors
 Burlington Harbor, Vt.
DIXON, S. O., Contractor.
 Racine Harbor, Wis.
DODGE, F. T., Contractor.
 Columbia River (Upper) and Snake River, Oreg. and Wash.
DODGE, N. G., Contractor.
 Charlevoix Harbor, Mich.
 Frankfort Harbor, Mich.
 Green Bay Harbor, Wis.
DOER, A., Assistant Engineer.
 Shark River, N. Y.
DOERFLINGER, A., Assistant Engineer.
 Amboy, from Perth and South to main ship-channel, Raritan Bay.
 Hudson River.
 Mattawan Creek, N. J.
 Newtown Creek, N. J.
 Passaic River at Newark, N. J.
 Raritan Bay, N. J.
 Shoal Harbor and Compton's Creek, N. J.
DOHERTY, E. P., Contractor.
 Red River, La. and Ark.
DOLBEY. (See **BANGS & DOLBEY.**)
DOLBEY, M., Contractor.
 Charleston Harbor, S. C.
DONALDSON, J. P., Contractor.
 Sand Beach, Mich.
DONNELLY, J. B., Contractor.
 Charlotte Harbor, N. Y.
 Oswego Harbor, N. Y.
DONOVAN, C., Assistant Engineer.
 Mississippi River at its mouth.
DOREY, I. T., Assistant Engineer.
 Red River, La. and Ark.
DOUGHERTY, J. B., Assistant Engineer.
 Allegheny River, Pa.
DOUGLASS, H. S., Assistant Engineer,
 Amite River, La.
 Bayou Andre, La.
 Bayou Black, La.
 Bayou De Glaise, La.

- DOUGLASS, H. S.—Continued.
 Bayou Little Cailou, La.
 Little Lake, La.
 Mississippi River, between mouth of
 Ohio and Head of Passes.
 Bayou Grand Cailou, La.
- DOYLE. (See STANTON & DOYLE.)
- DRAKE, C. F., *Contractor*.
 Manasquan River, N. J.
- DRAKE, D., *Contractor*.
 Manistee Harbor, Mich.
- DRAPER, T., *Contractor*.
 St. Jones River, Del.
- Du Bois, H., *Contractor*.
 Butternilk Channel, N. Y.
 Gowanus Bay, N. Y.
 Newport Harbor, R. I.
- Du Bois, M., & SON, *Contractors*.
 Bridgeport Harbor, Conn.
 Buttermilk Channel, N. Y.
 Canarsie Bay, N. Y.
 Flushing Bay, N. Y.
 Manasquan River, N. J.
 New Haven Harbor, Conn.
 Passaic River, below Newark, N. J.
 South River, N. J.
- DUNBAR, C. F., *Contractor*.
 Detroit River, Mich.
 Pultneyville Harbor, N. Y.
 Sand Beach, Mich.
 Sodus Harbor (Great), N. Y.
 Sodus Harbor (Little), N. Y.
- DUNBAR & SULLIVAN, *Contractors*.
 Detroit River, Mich.
- DUCHARME, FLETCHER & CO., *Contractors*.
 Saginaw River, Mich.
 St. Mary's River and Falls Canal.
 Sand Beach, Mich.
- DURHAM, C. W., *Assistant Engineer*.
 Cnivre River, Mo.
 Mississippi River (Upper), removal of
 snags, etc.
 Mississippi River, St. Paul to Des Moines
 Rapids.
 Mississippi River, Des Moines Rapids
 to mouth of Illinois River.
 Mississippi River, Rock Island Rapids.
- DURKEE, J. H., *Contractor*.
 St. John's River, Fla.
- DUPIERS, A. J., *Contractor*.
 St. Clair Flats, Mich.
- DUPRIES, JOHNSTON & CO., *Contractors*.
 Clinton River, Mich.
- DUVAL, A. L., *Assistant Engineer*.
 Green River, Ky., and tributaries.
 Kankakee River, Ind.
 Rough River, Ky.
 Tradewater River, Ky.
 Wabash River, Ind.
- EASTERN DREDGING COMPANY, *Contractors*.
 Boston Harbor, Mass.
 Cathance River, Me.
 Plymouth Harbor, Mass.
- EASTWICK, P. G., *Assistant Engineer*.
 Clearwater River, Idaho.
 Columbia River (Upper) and Snake
 River, Ore. and Wash.
 Columbia River, Ore.
- EASTWICK, P. G.—Continued.
 Neches River, Tex.
 Olympia Harbor, Wash.
- EATON, N. H., *Contractor*.
 San Joaquin River, N. Y.
- EDWARDS, C. H., *Contractor*.
 Block Island Harbor, R. I.
 Greenport Harbor, N. Y.
 Nantucket Harbor, Mass.
 Newburyport Harbor, Mass.
 Plymouth Harbor, Mass.
 Scituate Harbor, Mass.
 Taunton River, Mass.
 Thames River, Conn.
- EDWARDS, H. D., *Contractor*.
 Sand Beach, Mich.
- EDWARDS, N. M., *Assistant Engineer*.
 Fox and Wisconsin rivers.
- EDWARDS, W. S., *Assistant Engineer*.
 Appoquinimink Creek, Del.
 Little Creek, Del.
 St. Jones River, Del.
- EGAN, D., *Contractor*.
 Kanawha River (Great), W. Va.
- ELIAS, G., & BROTHER, *Contractors*.
 Dunkirk Harbor, N. Y.
 Erie (Presque Isle) Harbor, Pa.
 Wilson Harbor, N. Y.
- ELLIOTT, G. H., *Assistant Engineer*.
 Archers Hope River, Va.
 Black River, N. C.
 Currituck Sound.
 Edenton Bay and Harbor, N. C.
 Norfolk Harbor, Va.
 North Landing River, Va. and N. C.
 Perquimans River, N. C.
- ELLIS, T. G., *Assistant Engineer*.
 Connecticut River above Hartford,
 Conn.
 Connecticut River below Hartford,
 Conn.
- EMERSON, E. W., *Contractor*.
 Oakland Harbor, Cal.
- EMMICH & FEITH, *Contractors*.
 Bayou Bartholemew, Ark. and La.
 Bayou Bouff, La.
 Bayou D'Arbonne, La.
- ENGLISH, W. B., *Contractor*.
 Humboldt Bay Harbor, Cal.
- EPPINGER & RUSSEL, *Contractors*.
 Delaware Breakwater Harbor, Del.
 Lewes Harbor, Del.
- EWENS, J., *Assistant Engineer*.
 Mississippi River, between mouth of
 Ohio River and Head of Passes.
- EWING, W. H., & CO., *Contractors*.
 Muskingum River, Ohio.
 Ohio River (except Falls, etc.).
- FAGAN, W., *Contractor*.
 Tehefuncte River, La.
 Tickfaw River, La.
- FALBERT, P. F., *Contractor*.
 Columbia River, Ore.
- FARLEY, T. W., *Contractor*.
 Kanawha River (Great), W. Va.
- FARQUHAR, E. H., *Contractor*.
 Pensacola Harbor, Fla.
- FARRELL, T. M., *Assistant Engineer*.
 Bayou D'Arbonne, La.
 Bayous Roundaway and Vidal, La.

- FARRELL, T. M.**—Continued.
Lake Palmyra, La. and Miss.
Pagan Creek, Va.
Yazoo River, Miss.
- FEARING, H. L.**, *Contractor*.
Delaware Breakwater Harbor, Del.
Kanawha River (Great), W. Va.
- FEITH.** (See **EMMICK & FEITH.**)
- FENNER, J. H.**, *Contractor*.
Mamaroneck Harbor, N. Y.
New London Harbor, Conn.
Newport Harbor, R. I.
Southport Harbor, Conn.
Taunton River, Mass.
- FERGUSON, O. W.**, *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- FERRIS, G. H.**, *Contractor*.
Appomattox River, Va.
Archers Hope River, Va.
Cape Fear River, N. C., below Wilming-
ton.
Currituck Sound, Coanok Bay, and
North River Bar, N. C.
Delaware River, below Bridesburg.
Elk River, Md.
James River, Va.
North Landing River, Va. and N. C.
Potomac River at Mount Vernon.
- FIELD, P. G.**, *Contractor*.
Delaware Breakwater Harbor, Del.
- FINCH, R.**, *Contractor*.
Grand River, Mich., below Grand
Rapids.
- FINLEY, GARRET & WILSON**, *Contractors*.
Delaware Breakwater Harbor, Del.
- FIRTH, A. J.**, *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- FISHER, F. A.**, *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- FISK, C. B.**, *Assistant Engineer*.
Shenandoah River, Va. and W. Va.
- FISK, N. W.**, *Contractor*.
Swanton Harbor, Vt.
- FITZHUGH, R. H.**, *Assistant Engineer*.
Green River, Ky., and tributaries.
- FLAKE, A. & Co.**, *Contractors*.
Galveston Harbor, Tex.
- FLANNERY, J. D.**, *Contractor*.
East Chester Creek, N. Y.
- FLANNERY, W.**, *Contractor*.
Flushing Bay, N. Y.
New London Harbor, Conn.
Newtown Creek, N. Y.
Taunton River, Mass.
Thames River, Conn.
- FLNAK, A. D.**, *Contractor*.
Mississippi River, St. Paul to Des Moines
Rapids.
- FLETCHER.** (See **DUCHARME, FLETCHER
& Co.**)
- FLOOD, E.**, *Assistant Engineer*.
Red River, La.
- FORES, G. C. & Co.**, *Contractors*.
Baltimore Harbor, Md.
Calcasieu Pass, La.
Leonardtown Harbor, Md.
- FORES, G. C. & Co.**—Continued.
Mobile Harbor, Ala.
Moosebeck River at Jonesport, Me.
Nomini Creek, Va.
Portland Harbor, Me.
Potomac River, Washington, D. C.
FORD. (See **HAMILTON & FORD.**)
- FORSTER, C. W.**, *Assistant Engineer*.
Black River, S. C.
Georgetown Harbor, S. C.
Lockwood's Folly River, N. C.
Pee Dee River (Great), S. C.
Waccamaw River, N. C.
- FOSS, G. O.**, *Assistant Engineer*.
Mississippi River, reservoirs at sources
- FOSTER, A.**, *Contractor*.
Sacramento and Feather rivers, Cal.
- FOX, H. L. & Co.**, *Contractors*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- FOX, S. W.**, *Assistant Engineer*.
Missouri River, from mouth to Sioux
City.
- FRANK PIGEON DREDGING COMPANY,**
Contractors.
East Chester Creek, N. Y.
Delaware River.
Hyannis Breakwater Harbor, Mass.
Wood's Holl Harbor, Mass.
- FREEMAN, V.**, *Contractor*.
Currituck Sound, Coanok Bay, and
North River Bar, N. C.
- FREMONT, S. L.**, *Assistant Engineer*.
Brunswick Harbor, Ga.
Canal from St. Mary's River to Gulf
of Mexico, Fla.
St. John's River and Fernandina, Fla.
Savannah River, between Savannah
and Augusta.
- FRENCH, E. H.**, *Contractor*.
Fairport Harbor, Ohio.
Saginaw River, Mich.
St. Clair Flats, Mich.
Toledo Harbor, Ohio.
- FRENCH, G. Z.**, *Contractor*.
Cape Fear River, N. C., below Wil-
mington.
- FRENCH & ROONEY**, *Contractors*.
Toledo Harbor, Ohio.
- FRESENIUS, J. P.**, *Assistant Engineer*.
Noxubee River, Miss.
- FRIES, A. F.**, *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- FRITSCH, J. G.**, *Contractor*.
Ohio River (except Falls, etc.).
- FRIZELL, J. P.**, *Assistant Engineer*.
Cannon River, Minn.
Mississippi River, reservoirs at sources.
Mississippi River, above Falls of St.
Anthony.
Superior Bay and St. Louis Bay, Wis.
- FRÖBEL, B. W.**, *Assistant Engineer*.
Chattahoochee River, Ga. and Ala.
Ocmulgee River, Ga.
Oconee River, Ga.
- FROELICH, J. C. & Co.**, *Contractors*.
Cape Fear River, N. C., below Wil-
mington.

- FROST, F. W., *Assistant Engineer*.
Broad, Lynn Haven and Link Horn
Bays, Va.
Norfolk Harbor, Va.
- FULLER, C. A., *Assistant Engineer*.
Fox and Wisconsin rivers.
- FULLER, W. D., *Contractor*.
Hudson River, N. Y.
- FULTON TOW-BOAT COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- GALL, A., *Contractor*.
San Joaquin River, Cal.
- GARDEN, H. D., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- GARDNER, F. B., *Contractor*.
Pensaukee Harbor, Wis.
- GARRET. (See FINLEY, GARRET & WILSON.)
- GATLING, W. F., *Contractor*.
Appomattox River, Va.
- GAY, F. B., *Contractor*.
Dunkirk Harbor, N. Y.
Oswego Harbor, N. Y.
Pultneyville Harbor, N. Y.
- GAYNOR, E. H., *Contractor*.
Altamaha River, Ga.
Savannah River, between Savannah
and Augusta.
- GAYNOR, J. F., *Contractor*.
James River, Va.
Savannah River, at and below Augusta.
- GEER, I. F., *Contractor*.
Saugatuck Harbor, Mich.
- GEISSENDORFER. (See SHERWOOD, STRIEBERGER, & GEISSENDORFER.)
- GENDER, G. W., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- GEORGE, T. I., *Assistant Engineer*.
Pocomoke River, Md.
Tuckahoe Creek, Md.
- GERVIN & BIETRY, *Contractors*.
Red River, La. and Ark.
- GIBSON & GRANGER, *Contractors*.
Buffalo Harbor, N. Y.
- GIELOW, H. J., *Assistant Engineer*.
Appomattox River, Va.
Nansemond River, Va.
Tennessee River above and below
Chattanooga.
- GIESLER, E. A., *Assistant Engineer*.
Brandywine River, Del.
Delaware River.
Frankford Creek, Pa.
Leipsic River, Del.
Mantua Creek, N. J.
Mauprice River, N. J.
Murder Kiln Creek, Del.
Pensauken Creek, N. J.
Raccoon River, N. J.
Woodbury Creek, N. J.
- GILBERT, C., *Contractor*.
Georgetown Harbor, S. C.
- GILBERT, C. P., *Assistant Engineer*.
Caseville Harbor, Mich.
Sand Beach, Mich.
- GILBERT, H. P., *Contractor*.
Potomac River, D. C.
- GILL, J. H., *Contractor*.
Staunton River, Va.
- GILLEN. (See KNAPP & GILLEN.)
- GILLEN & KIRBY, *Contractors*.
Grand Haven Harbor, Mich.
Muskegon Harbor, Mich.
- GILLESPIE, J. A., *Assistant Engineer*.
Boquet River, N. Y.
Mississippi River, St. Paul to Des
Moines Rapids.
- Otter Creek, Vt.
Port Henry, N. Y.
Port Marshall Harbor, N. Y.
Rouse's Point Harbor, N. Y.
- GILLETTE, J. H., *Contractor*.
Grand Marais Harbor of Refuge, Mich.
Ontonagon Harbor, Mich.
- GILLIES, D. A., *Contractor*.
Mattaponi River, Va.
- GILLILAND, J., *Contractor*.
Kanawha River (Great), W. Va.
- GILLMORE. (See STANG & GILLMORE.)
- GINN, J., *Contractor*.
Richmond Harbor, Kennebec River,
Me.
- GLASSCOCK, E., *Contractor*.
Ainite River, La.
- GLEASON & GOSNELL, *Contractors*.
Falls of Ohio River.
- GORTHALS, G. W., *Assistant Engineer*.
New Harbor, Ind.
Owensborough Harbor, Ky.
- GOODRICH, C. G., *Contractor*.
Connecticut River above Hartford,
Conn.
- GORHAM, H. B., *Assistant Engineer*.
New Haven Harbor, Conn.
- GOSNELL. (See GLEASON & GOSNELL.)
- GOULD, W. A., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- GOURLEY, G. W., *Contractor*.
Kentucky River, Ky.
- GRAHAM, J. C., *Contractor*.
Ohio River (except Falls, etc.).
- GRANGER. (See GIBSON & GRANGER.)
- GREEN. (See HICKLER & GREEN.)
- GREEN BAY DREDGE AND PILE-DRIVER
COMPANY, *Contractors*.
Frankfort Harbor, Mich.
Green Bay Harbor, Wis.
Kewaunee Harbor, Wis.
Manistee Harbor, Mich.
Manitowoc Harbor, Wis.
Menomonee Harbor, Mich. and Wis.
Oconto Harbor, Wis.
Sturgeon Bay Canal, Wis.
- GREEN BAY DREDGING COMPANY, *Contractors*.
Cedar River, Mich.
Cheboygan Harbor, Mich.
Chicago Harbor, Ill.
- GREEN, O. B., *Contractor*.
Calumet Harbor, Ill.
- GREGORY, J. B., *Assistant Engineer*.
Muskingum River, Ohio.
- GREGORY, S. E. M., *Assistant Engineer*.
Osage River, Mo. and Kans.
- GWINNER, F., *Contractor*.
Ohio River (except Falls, etc.).

- GWYNN, W., Contractor.**
 Petaluma Creek, Cal.
 San Joaquin, Cal.
HAAGENSEN, S., Assistant Engineer.
 Ipswich River, Mass.
 Merrimac River, Mass.
 Powow River, Mass.
 Sandy Bay, Mass.
HABERSHAM, R. A., Assistant Engineer.
 Alsea River and Bay, Oreg.
 Baker's and Shoalwater bays, Wash.
 Chehalis River, Wash.
 Columbia River, Oreg.
 Columbia River (Lower), Oreg.
 Cowlitz River, Wash.
 Gray's Harbor, Wash.
 Skagit, Stielaquamiah, and Nootsack rivers, Wash.
 Mupqua River, Oreg.
 Willamette River (Upper), Oreg.
HACKETT, J., Contractor.
 Humboldt Bay Harbor, Cal.
 Oakland Harbor, Cal.
 Petaluma Creek, Cal.
 San Joaquin, Cal.
 Wilmington Harbor, Cal.
HAINES, H., Assistant Engineer.
 Blackwater River and East Bay, Fla.
 Chippewa River at Yellowbank, Wis.
 Chipola River, Fla.
 Clearwater Harbor, Fla.
 Holmes Creek, Fla.
 Lagrange Bayou, Fla.
 Pea River, Ala.
 Pensacola Harbor, Fla.
HAMILTON & FORD, Contractors.
 Merrimac River, Mass.
HAMILTON, H., Contractor.
 Portsmouth Harbor, N. H.
 Richmond Island, Me.
HAMILTON, I., Contractor.
 Newburyport Harbor, Mass.
HAMILTON, J. T., Contractor.
 Rockland Harbor, Me.
HAMILTON, J. A., & R. SOULE, Contractors.
 Rockland Harbor, Me.
 Saco River (breakwater), Me.
HAMILTON, J. S., & Co., Contractors.
 Pearl River, Carthage, and Jackson.
HAMILTON, R., Contractor.
 Boston Harbor, Mass.
 Malden River, Mass.
 Plymouth Harbor, Mass.
 Saco River, Me.
HAMILTON, S. F., Contractor.
 Royal River, Me.
HAMILTON & SAWYER, Contractors.
 Cochecho River, N. H.
HAMILTON, S. M., & Co., Contractors.
 Kanawha River (Little), W. Va.
HAMMOND, S. A., Contractor.
 Potowomut River, R. I.
HAMMOND, W. H., Assistant Engineer.
 Missouri River, from mouth to Sioux City.
HAMPTON, F. T., Assistant Engineer.
 Grass River, N. Y.
 Hudson, Wis.
- HAMPTON, F. T.—Continued.**
 Niagara River at mouth, Tonawanda, N. Y.
 Ogdensburg Harbor, N. Y.
 Port Day Harbor, N. Y.
 Waddington Harbor, N. Y.
HANDCOCK & KELSO, Contractors.
 Oakland Harbor, Cal.
HANNAH. (See WALSH & HANNAH.)
HANNAH, G., Contractor.
 Calumet Harbor, Ill.
 Chicago Harbor, Ill.
HANSON & SCOVE, Contractors.
 Kewaunee Harbor, Wis.
HARDING, H., Assistant Engineer.
 Cedar Keys Harbor, Fla.
 Old Town Creek, Miss.
 Tombigbee River above Columbus, Miss.
HARDIN, T. J., Contractor.
 Kentucky River, Ky.
HARLOW, J. H., Assistant Engineer.
 Bellaire Harbor, Ohio.
 Point Pleasant, W. Va.
HARMS, C. H., Contractor.
 Sheboygan Harbor, Wis.
HAROLD, McDONALD, & Co., Contractors.
 Kanawha River (Great), W. Va.
HARRIS & BLACK, Contractors.
 Kanawha River (Great), W. Va.
HARRIS, T. M., Assistant Engineer.
 Missouri River, from mouth to Sioux City.
HARRIS, W. J., Contractor.
 Pultneyville Harbor, N. Y.
 Wilson Harbor, N. Y.
HARRISON, J., Assistant Engineer.
 Obion River, Tenn.
HARRISON, T. L., Assistant Engineer.
 Biloxi Harbor, Miss.
 Horn Island Pass, Miss.
 Keyport Harbor, N. J.
 Pascagoula River, Miss.
 Ship Island Harbor, Miss.
HARRISON, Z., Assistant Engineer.
 Cache River, Ark.
 Deer River, North Forked, Tenn.
 Deer River, South Forked, Tenn.
HARTFORD AND NEW YORK STEAMBOAT COMPANY, Contractors.
 Connecticut River below Hartford, Conn.
HARTFORD AND NEW YORK TRANSPORTATION COMPANY, Contractors.
 Connecticut River above Hartford, Conn.
HARTFORD DREDGING COMPANY, Contractors.
 Narragansett Bay (Little), R. I. and Conn.
 Newport Harbor, R. I.
 Stamford Harbor, Conn.
 Thames River, Conn.
HATFIELD, A. P., Assistant Engineer.
 Mississippi River, between mouth of Ohio River and Head of Passes.
HAWKINS, R. F., Contractor.
 Rouse's Point Harbor, N. Y.

- HAY, A., *Contractor*.
Sacramento and Feather rivers, Cal.
- HAYES. (See HEMMENWAY & HAYES.)
- HEADING, W. H., *Assistant Engineer*.
Kenosha Harbor, Wis.
Milwaukee Bay, Wis.
Milwaukee Harbor, Wis.
Oconto Harbor, Wis.
Racine Harbor, Wis.
Waukegan Harbor, Ill.
- HEFFRON, I., *Contractor*.
Galveston Harbor, Tex.
- HEFRIGHT, F., *Contractor*.
Kanawha River (Great), W. Va.
- HELM, G. M., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- HEMMENWAY & HAYES, *Contractors*.
Ashtabula Harbor, Ohio.
Erie (Presque Isle) Harbor, Pa.
- HENDERSON. (See POST & HENDERSON.)
- HENDERSON. (See NEYLAND & HENDERSON.)
- HERR, H. B., *Assistant Engineer*.
Hennepin Canal.
Mississippi River, between mouth of
Ohio River and Head of Passes.
Mississippi River, water-gauges on.
- HERR, H. B., *Contractor*.
Grand Haven Harbor, Mich.
Milwaukee Bay, Wis.
Muskegon Harbor, Mich.
- HERR, H. B., & Co., *Contractors*.
Calumet Harbor, Ill.
Kenosha Harbor, Wis.
Milwaukee Harbor, Wis.
Racine Harbor, Wis.
South Haven Harbor, Mich.
- HERRON, J., *Assistant Engineer*.
Shenandoah River, Va. and W. Va.
- HERRON, M., *Contractor*.
Delaware River, between Trenton and
Bridensburg.
- HETH, H., *Assistant Engineer*.
Pee Dee River (Great), S. C.
Waccamaw River, N. C.
Wateree River, S. C.
- HICKLER, J., *Contractor*.
St. Mary's River and Falls Canal.
Sand Beach, Mich.
- HICKLER, GREEN & Co., *Contractors*.
Saginaw River, Mich.
- HICKLER & GREEN, *Contractors*.
St. Mary's River and Falls Canal.
- HIDER, A., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- HILL WRECKING COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- HINE, H. H., *Contractor*.
Erie (Presque Isle) Harbor, Pa.
- HINGSTON, E. J., *Contractor*.
Buffalo Harbor, N. Y.
Niagara River, at mouth of Tonawanda
Creek, N. Y.
- HINGSTON, W. E., *Contractor*.
Wilson Harbor, N. Y.
- HINGSTON & WOODS, *Contractors*.
Dunkirk Harbor, N. Y.
- HINKLE, W. A., *Assistant Engineer*.
Galveston Harbor, Tex.
- HITCHCOCK & BYRNES, *Contractors*.
Galveston Harbor, Tex.
- HOAG, J. V., *Assistant Engineer*.
Allegheny River, Pa.
Tionesta Creek, Pa.
- HOAG, J. V., *Contractor*.
Kentucky River, Ky.
Ohio River (except Falls, etc.).
- HOFFMAN, E. F., *Assistant Engineer*.
Mississippi River, St. Paul to Des Moines
Rapids.
Mississippi River, Des Moines Rapids to
mouth of Illinois River.
Rock Island Rapids, Mississippi River.
- HOFFMAN, W. H., *Assistant Engineer*.
Bayou Terrebonne, La.
Pearl River, Edinburgh and Carthage.
Tchefunote River, La.
Vermillion River, La.
- HOLBROOK, J. B., *Assistant Engineer*.
Buckhannon River, W. Va.
Taggart's Valley River, W. Va.
- HOLBROOK, J. B., *Contractor*.
Ohio River (except Falls, etc.).
- HOLDEN, C. M., *Contractor*.
Aransas Pass and Bay, Tex.
Plymouth Harbor, Mass.
Provincetown Harbor, Mass.
- HOLLEY, B., *Assistant Engineer*.
Canal (ship) from Lake Erie to Wabash
and Ohio rivers.
- HOLLMAN, O., *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- HOLMES & CHALMERS, *Contractors*.
Clearwater River, Idaho.
- HOLMES & SWEENEY, *Contractors*.
Columbia River (Lower), Oreg.
- HOLT, L. W., *Contractor*.
Columbia River, Oreg.
- HOOKE, R., *Assistant Engineer*.
Tennessee River, above and below Chat-
tanooga.
- HOPKINS & LE BARON, *Contractors*.
Volusia Bar, Fla.
- HORTON, B. S., *Contractor*.
Cleveland Harbor, Ohio.
- HOSKINS. (See LUCE & HOSKINS.)
- HOWARD, H., & Co., *Contractors*.
Mississippi River (Upper), removal of
snags, etc.
Sand Beach, Mich.
- HOWELL, A. J., *Contractor*.
Delaware Breakwater, Del.
- HOWELL, B. C., *Assistant Engineer*.
Big Sandy River, W. Va. and Ky.
- HOWELL, D. V., *Contractor*.
Clinton Harbor, Conn.
New Haven Harbor, Conn.
- HOWELL, J. S., *Contractor*.
Brunswick Harbor, Ga.
- HOWLETT, A. A., *Contractor*.
Charleston Harbor, S. C.
St. John's River, Fla.
- HUBBELL, C. G., *Contractor*.
Cleveland Harbor, Ohio.
- HUBBELL, T. M., *Contractor*.
Belle River, Mich.

- HUBBELL, T. M.—Continued.
 Clinton River, Mich.
 Saginaw River, Mich.
 Sand Beach, Mich.
 Sebawaing Harbor, Mich.
 HUBBLE & SKILDON, *Contractors*.
 Saginaw River, Mich.
 HULL, F. A., *Contractor*.
 Appomattox River, Va.
 HUMPHRIES, C., *Assistant Engineer*.
 Black River, N. C.
 Cambridge Harbor, Md.
 Cape Fear River, N. C.
 Duck Creek, Del.
 Fairlee Creek, Md.
 HURST, R., *Assistant Engineer*.
 Agate Bay, Minn.
 HUTCHINGS, T. E., *Assistant Engineer*.
 Oconto Harbor, Wis.
 HUTCHINSON, W. E., *Contractor*.
 Chicago Harbor, Ill.
 HUTTON, N. H., *Assistant Engineer*.
 Cheesapeake and Delaware bays.
 Shenandoah River, Va. and W. Va.
 HUTTON, W. R., *Assistant Engineer*.
 Annapolis Harbor, Md.
 Baltimore Harbor, Md.
 St. Jerome's Creek, Md.
 HYATT, F. A., *Contractor*.
 Sabine River, La. and Tex.
 HYATT, F. A., & Co., *Contractors*.
 Sabine Pass, Tex.
 HYATT. (See SHANNON & HYATT.)
 INGRAM, R., *Contractor*.
 Yaquina Bay, Oreg.
 IRISH. (See DAWES, IRISH & Co.)
 ISHERWOOD, T. G., *Contractor*.
 Mississippi River. St. Paul to Des Moines Rapids.
 JACKSON, B. C., *Contractor*.
 San Joaquin River, Cal.
 JAMES, W. H., *Assistant Engineer*.
 Cape Fear River, N. C.
 Lillington River, N. C.
 Pamlico and Tar River, N. C.
 Town Creek, N. C.
 Yadkin River, N. C.
 JENKINS & VAN GORDER, *Contractors*.
 Mississippi River. St. Paul to Des Moines Rapids.
 JENKS, J., & Co., *Contractors*.
 Sand Beach, Mich.
 JENNINGS, O. J., *Contractor*.
 Erie (Presque Isle) Harbor, Pa.
 JESSEN, G. M., *Assistant Engineer*.
 Columbia River, Oreg.
 JOHNSON, A., *Assistant Engineer*.
 Chippewa River, Wis.
 Mississippi River, reservoir at sources.
 JOHNSON, E. H., *Assistant Engineer*.
 Mississippi River, between mouths of Illinois and Ohio rivers.
 JOHNSON, J. B., *Assistant Engineer*.
 Mississippi River, between mouth of Ohio River and Head of Passes.
 JOHNSON, J. L., *Contractor*.
 Lake Champlain, N. Y.
 Rouse's Point Harbor, N. Y.
 JOHNSON. (See MCNELLIS & JOHNSON.)
- JOHNSTON, T. T., *Assistant Engineer*.
 Gasconade River, Mo.
 Missouri River, between Sioux City and Fort Benton.
 JOHNSTON. (See DUPRIES, JOHNSTON & Co.)
 JONES, H. C., *Contractor*.
 Kentucky River, Ky.
 JORDAN, D., *Contractor*.
 Oakland Harbor, Cal.
 JORDAN, E. C., *Assistant Engineer*.
 Cathance River, Me.
 JOSEPH EDWARDS DREDGING COMPANY, *Contractors*.
 New York Harbor (Gedney's and main ship-channel).
 JOSLYN. (See BROOKS & JOSLYN.)
 JUDSON, W. P., *Assistant Engineer*.
 Lake Champlain, N. Y.
 Ogdensburg Harbor, N. Y.
 Oswego Harbor, N. Y.
 Plattsburgh Harbor, N. Y.
 Rouse's Point Harbor, N. Y.
 KALLMAN, H., *Assistant Engineer*.
 Detroit River, Mich.
 Saginaw River, Mich.
 KANTERS & SON, *Contractors*.
 Brazos River, Tex.
 Matagorda Bay, Tex.
 KEEPERS & RIDDLE, *Contractors*.
 Muskegon Harbor, Mich.
 White River Harbor, Mich.
 KELLEY, J., *Contractor*.
 Shrewsbury River, N. J.
 KELLEY, J., & Co., *Contractors*.
 Columbia River (Upper) and Snake River, Wash. and Oreg.
 KELLY, S. A., *Contractor*.
 Manasquan River, N. J.
 KELLY & BENNERMAN, *Contractors*.
 Sodus Harbor (Little), N. Y.
 KELLY, MAUS & Co., *Contractors*.
 Grand Haven Harbor, Mich.
 Muskegon Harbor, Mich.
 Sangatuck Harbor, Mich.
 White River Harbor, Mich.
 KELLOGG, G., *Contractor*.
 Oswego Harbor, N. Y.
 Toledo Harbor, Ohio.
 KELLOGG, G., & Co., *Contractors*.
 Sodus Harbor (Great), N. Y.
 Cowlitz River, Wash.
 KELSO. (See HANDCOCK & KELSO.)
 KENNEDY DREDGING COMPANY, *Contractors*.
 Cathance River, Me.
 Richmond Harbor, Me.
 KERCHNER, A., *Contractor*.
 Mississippi River, St. Paul to Des Moines Rapids.
 KERR, STANG & GILLMORE, *Contractors*.
 Fairport Harbor, Ohio.
 KERWIN, D., *Contractor*.
 Mississippi River, between mouths of Illinois and Ohio rivers.
 KIMBALL, S. N., *Contractor*.
 Apalachicola Bay, Fla.
 Caloosahatchee River, Fla.
 Cedar Keys Harbor, Fla.

KIMBALL, S. N.—Continued.
 Keyport Harbor, N. J.
 Pascagoula River, Miss.
 Pearl River below Jackson.
 Pensacola Harbor, Fla.
 Suwanee River, Fla.
 Tennessee River above and below Chattanooga.

KIMBARK, S. D., *Contractor*.
 St. Joseph Harbor, Mich.

KIMBERLY, W. H., *Assistant Engineer*.
 Cherrystone Creek, Va.

KIMP, W., & SON, *Contractors*.
 Ohio River (except Falls, etc.).

KING, J. F., *Contractor*.
 Ohio River (except Falls, etc.).

KINGSLEY, M., *Assistant Engineer*.
 Jamaica Bay and Rockaway Inlet.
 Niagara River at mouth Tonawanda Creek, N. Y.

KITCHEN, N. Y.
 Sackett's Harbor, N. Y.

KIRBY. (See **GILLEN & KIRBY**)

KIRBY, T. W., *Contractor*.
 Grand Haven Harbor, Mich.
 Muskegon Harbor, Mich.
 St. Joseph Harbor, Mich.

KIRK & ABRAHAM, *Contractors*.
 Kentucky River, Ky.

KIRK & CO., *Contractors*.
 Ohio River (except Falls, etc.).

KIRKPAUGH, A., *Contractor*.
 Rappahannock River, Va.

KLIMM, R., *Assistant Engineer*.
 Mississippi River, between mouth of Ohio River and Head of Passes.

KNAPP & GILLEN, *Contractors*.
 Kenosha Harbor, Wis.
 Port Washington Harbor, Wis.
 Racine Harbor, Wis.
 Two Rivers Harbor, Wis.
 Waukegan Harbor, Ill.

KNOX. (See **BECKFORD, KNOX & CO.**)

KULP. (See **MARTZ, KULP & MCWILLIAMS**)

LAMB, C. D., *Assistant Engineer*.
 Mississippi River, between mouths of Illinois and Ohio rivers.

LARA, ROSS & CO., *Contractors*.
 Cumberland Sound, Fla. and Ga.
 St. John's River, Fla.

LARKIN & PATRICK, *Contractors*.
 St. Mary's River and Falls Canal.

LAVALIN, J. D., *Contractor*.
 Missouri River (snags) between Kansas City and the mouth.

LAWRENCE, J. S., *Contractor*.
 St. John's River and Fernandina, Fla.

LEARY, J. D., *Contractor*.
 Raritan River, N. J.

LEATHERN & SMITH, *Contractors*.
 Green Bay Harbor, Wis.
 Oconto Harbor, Wis.
 St. Joseph Harbor, Mich.

LEAVITT, H. A., *Assistant Engineer*.
 Detroit River, Mich.

LE BARON. (See **HOPKINS & LE BARON**)

LE BARON, J. F., *Assistant Engineer*.
 Indian River, Fla.

LE CONTE, L. J., *Assistant Engineer*.
 Napa River, Cal.

LE CONTE, L. J.—Continued.
 Oakland Harbor, Cal.

LEE, F., *Contractor*.
 Ogdeburgh Harbor, N. Y.
 Oswego, N. Y.

LEE, J. J., *Assistant Engineer*.
 Cohansey Creek, N. J.
 Maurice River, N. J.
 Salem River, N. J.

LEIPER & LEWIS, *Contractors*.
 Marcus Hook, Del.

LEMON, J. M., *Contractor*.
 San Joaquin Harbor, Cal.

LEWIS. (See **LEIPER & LEWIS**)

LEWIS. (See **MALLOY & LEWIS**)

LEWIS, F. D., *Assistant Engineer*.
 Arkansas River at Fort Smith, Ark.

LEWIS, H. J., *Contractor*.
 Milford Harbor, Conn.

LEWIS, W. D., *Contractor*.
 Kanawha River (Great), W. Va.

LEWIS & MERWIN, *Contractors*.
 Housatonic River, Conn.

LIBBY, E. D., *Assistant Engineer*.
 Mississippi River, between mouths of Illinois and Ohio rivers.

LILJENCRANTZ, G. A. M., *Ass't Engineer*.
 Calumet Harbor, Ill.
 Calumet River, Ill.
 Hennepin Canal.

LINAHAN, B. E., *Contractor*.
 Dubuque Ice Harbor, Iowa.
 Mississippi River, St. Paul to Des Moines Rapids.

LINAHAN & CO., *Contractors*.
 Beaufort Harbor, N. C.

LINN, J. L., *Contractor*.
 Erie (Presque Isle) Harbor, Pa.

LITTLEFIELD, R. S., *Assistant Engineer*.
 Coos Bay, Oreg.
 Coquille River, Oreg.

LOCKE. (See **ANDREWS & LOCKE**)

LOCKE, C. A., *Assistant Engineer*.
 Caney Fork River, Tenn.
 Holston River, Tenn.
 Ocmulgee River, Ga.
 Oconee River, Ga.
 Tennessee River above and below Chattanooga.

LOCKE, T. G., *Assistant Engineer*.
 Chester and Ridley Creek, Pa.
 Delaware River.

LOMAS FORGE AND BRIDGE WORKS, *Contractors*.
 Kentucky River, Ky.

LONG, G. L., *Contractor*.
 Brazos Santiago Harbor, Tex.
 Buffalo Bayou, Tex.
 Matagorda Bay, Tex.
 Mobile Harbor, Ala.
 Trinity River, Tex.

LORENZ & TERKELSON, *Contractors*.
 Oakland Harbor, Cal.

LOUISIANA JETTY AND LIGHTERING COMPANY, *Contractors*.
 Sabine Pass, Tex.

LOWE, E. R., *Contractor*.
 Potomac River, Washington, D. C.

- LUCE, J. V., *Contractor*.
 Greenport Harbor, N. Y.
 LUCE & HOSKINS, *Contractors*.
 Greenport Harbor, N. Y.
 Hudson River, N. Y.
 LUDLOW, E., *Assistant Engineer*.
 Indian River, Del.
 LUKENS, E. J., *Contractor*.
 Oakland Harbor, Cal.
 LUNT, I., *Contractor*.
 Marcus Hook, Del.
 Wilmington Harbor, Del.
 LYNCH, H., *Contractor*.
 San Joaquin Harbor, Cal.
 LYON, T. R., *Contractor*.
 White River Harbor, Mich.
 LYONS, J. E., *Contractor*.
 Potomac River.
 MACDOUGALL, C. P., *Contractor*.
 Grand Marais Harbor, Minn.
 MACKENZIE. (See WARD & MACKENZIE.)
 MACK, M. J., *Assistant Engineer*.
 Apalachicola River, Fla.
 MCALPINE. (See BLANCHARD & MCALPINE.)
 MCBEE, S., *Assistant Engineer*.
 Congaree River, S. C.
 MCCLELLAN, C., *Assistant Engineer*.
 Mississippi River, reservoir at sources.
 MCCONGHEY, J. S., *Contractor*.
 White River Harbor, Mich.
 MCCONNELL, D. W., *Contractor*.
 Sodus Harbor (Little), N. Y.
 MCCOY, D. B., *Contractor*.
 Ashtabula Harbor, Ohio.
 MCCURDY, W. H., *Contractor*.
 Cleveland Harbor, Ohio.
 McDERMOTT, J., *Contractor*.
 Boston Harbor, Mass.
 Housatonic River, Conn.
 Merrimac River, Mass.
 Narragansett Bay (Little), R. I. and Conn.
 Norwalk Harbor, Conn.
 Southport Harbor, Conn.
 Sumpawanus Inlet, N. Y.
 Wareham Harbor, Mass.
 Wood's Holl Harbor, Mass.
 McDERMOTT & DALY, *Contractors*.
 Block Island Harbor, R. I.
 Connecticut River below Hartford, Conn.
 McDONALD & BOALT, *Contractors*.
 Sturgeon Bay (Canal), Wis.
 McDOUGALL & McLENNAN, *Contractors*.
 Ontonagon Harbor, Mich.
 MCGINN, J. W., *Contractor*.
 Cheboygan Harbor, Mich.
 Sand Beach, Mich.
 MCGRAFT & MONTGOMERY, *Contractors*.
 Muskegon Harbor, Mich.
 MCKAY, R. C., *Contractor*.
 Savannah River at and below Augusta.
 MCKENZIE, G. W. & A. F., *Contractors*.
 Ashtabul Harbor, Ohio.
 Erie (Presque Isle) Harbor, Pa.
 MCKENZIE, K., *Contractor*.
 Ashtabula Harbor, Ohio.
 MCKENZIE & BARRETT, *Contractors*.
 Ashtabula Harbor, Ohio.
 MCKINNON, A., *Contractor*.
 San Joaquin Harbor, Cal.
 MCKNEW, W. H., *Assistant Engineer*.
 Missouri River, from mouth to Sioux City.
 MCKOWN, J. D., *Assistant Engineer*.
 White Oak River, N. C.
 McLENNAN. (See McDOUGALL & McLENNAN.)
 McNAUGHTON, D., *Contractor*.
 Dunkirk Harbor, N. Y.
 Erie (Presque Isle) Harbor, Pa.
 MCNEE. (See BENSON & MCNEE.)
 MCNEE. (See VON SCHMIDT & MCNEE.)
 McNELLIS & JOHNSON, *Contractors*.
 Sand Beach, Mich.
 McWILLIAMS. (See MARTZ, KULP, McWILLIAMS & Co.)
 MADISON, M. J., *Contractor*.
 Redwood Harbor, Cal.
 MAGUIRE, J., *Contractor*.
 Apalachicola Bay, Fla.
 Manatee River, Fla.
 Vermillion River, La.
 MAHON. (See PORTER, TUCKER & MAHON.)
 MALCOLM, W. S., *Contractor*.
 Sodus Harbor (Great), N. Y.
 MALLOY & LEWIS, *Contractors*.
 Falls of Ohio River.
 MARIS. (See SALMON & MARIS.)
 MARIETTA CHAIR COMPANY, *Contractors*.
 Muskingum River, Ohio.
 MARK, C. D., *Assistant Engineer*.
 Mississippi River, between mouth of Ohio River and Head of Passes.
 MARR, G. A., *Assistant Engineer*.
 Mississippi River, St. Paul to Des Moines Rapids.
 Portage Lake and Lake Superior Ship Canal.
 MARSHALL, J. B., *Contractor*.
 Hudson River, N. Y.
 MARTIN, A., *Contractor*.
 Cape Fear River, N. C., below Wilmington.
 MARTIN, W., *Assistant Engineer*.
 Ohio River (except Falls, etc.).
 MARTZ, KULP, McWILLIAMS & Co., *Contractors*.
 Kanawha River (Great), W. Va.
 MARWITZ, H., & Co., *Contractors*.
 Galveston Harbor, Tex.
 MAUS. (See KELLY, MAUS & Co.)
 MAYHEW, J. H., *Assistant Engineer*.
 Bear Creek, Miss.
 Little Tennessee River.
 MEACHAM & WRIGHT, *Contractors*.
 Des Moines Rapids, Mississippi River, including canal and dry-dock.
 MEIGS, J. L., *Assistant Engineer*.
 Charlotte Harbor and Peace Creek, Fla.
 Clearwater Harbor, Fla.
 Peace River, Fla.
 Withlacoochee River, Fla.
 MEIGS, M., *U. S. Civil Engineer*.
 Des Moines Rapids, Mississippi River, including canal and dry-dock.
 Galena River and Harbor, Ill.

MEIGS, M.—Continued.

Mississippi River, Des Moines Rapids to Mouth of Illinois River.

Mississippi River, St. Paul to Des Moines Rapids.

MELVIN, W. C., Assistant Engineer.

Mississippi River, between mouth of Ohio River and Head of Passes.

Onachita and Black rivers, La. and Ark.

MERRY, C. D., Contractor.

Fairport Harbor, Ohio.

MERSEREAU, C. V., Assistant Engineer.

Mississippi River, between mouths of Illinois and Ohio rivers.

MERWIN. (See LEWIS & MERWIN.)**MEYER, G. A., Contractor.**

Bayou Teche, La.

Pearl River below Jackson.

Vermillion River, La.

MICHAEL, L., Contractor.

Columbia River, Oreg.

MICHIGAN BARGE COMPANY, Contractors.

Muskegon Harbor, Mich.

White River Harbor, Mich.

MILLER CHAIN COMPANY, Contractors.

Ohio River (except Falls, etc.).

MILLER, H. C., Assistant Engineer.

Wekiva River, Fla.

MILLER, J., Contractor.

Potomac River, D. C.

MITCHELL, A. J., Contractor.

Kanawha River (Little), W. Va.

MITCHELL, C. E., Contractor.

Chicago Harbor, Ill.

Ludington Harbor, Mich.

Pentwater Harbor, Mich.

St. Mary's River and Falls Canal.

MITCHELL, A. J., Assistant Engineer.

Cross Village Harbor, Mich.

St. Joseph River, Mich.

MITCHELL, R. C., Contractor.

Susquehanna River, Pa.

MITCHELL, W. G., Contractor.

Pascagoula River, Miss.

MITCHELL, W. S., Assistant Engineer.

Mississippi River, between mouths of Illinois and Ohio rivers.

MOLTHROP, W. H., & Co., Contractors.

Block Island Harbor, R. I.

Westport Harbor, Mass.

Wood's Holl Harbor, Mass.

MONTGOMERY. (See MCGRAFT & MONTGOMERY.)**MONTGOMERY, J. B., Contractor.**

Columbia River (Upper) and Snake River, Oreg.

MONTGOMERY, P. C., Assistant Engineer.

Bayou Loggy, Lake Deslensau, etc., La.

Bayou Petit Anse, La.

Cane River, La.

Onachita and Black rivers, La. and Ark.

Steel's Bayou, Miss.

Sulphur River, Tex.

MOODY. (See SANGER & MOODY.)**MOORE, J. R., Contractor.**

Tampa Bay, Fla.

MOORE, R., Contractor.

Beaufort Harbor and New River, N. C.

MOORE, R.—Continued.

Brazos River, Tex.

Brazos Santiago Harbor, Tex.

Buffalo Bayou, Tex.

Cape Fear River, N. C., below Wilmington.

Cedar Keys Harbor, Fla.

Manatee River, Fla.

Mobile Harbor, Ala.

New Berne to Beaufort, N. C.

New River, N. C.

Potomac River, D. C.

St. John's River, Fla.

Santee River and Canal, S. C.

MOORE & WRIGHT, Contractors.

Bangor Harbor and Penobscot River, Me.

Boston Harbor, Mass.

Little Harbor at Portsmouth, N. H.

Lubec Channel, Me.

Lynn Harbor, Mass.

Moosabec River at Jonesport, Me.

Narragansett River, Me.

Portland Harbor, Me.

MORGAN, J., Contractor.

Kanawha River (Great), W. Va.

MORGAN, T. P., Contractor.

Choptank River, Md.

Edenton Bay and Harbor, N. C.

Leonardtown Harbor, Md.

New Berne to Beaufort, N. C.

Norfolk Harbor, Va.

Potomac River, D. C.

St. Jerome's Creek, Md.

Urbana Creek, Va.

York River, Va.

MORRIS, J. H., Contractor.

Ohio River (except Falls, etc.).

MORRIS, T., Contractor.

Kentucky River, Ky.

MORRIS & Co., Contractors.

Kanawha River (Little), W. Va.

MORRIS & CUMINGS, Contractors.

Choptank River, Md.

New Haven Harbor, Conn.

Passaic River, N. J., below Newark.

MORRIS & CUMINGS DREDGING COMPANY, Contractors.

Baltimore, Md.

Newtown Creek, N. J.

Norfolk Harbor, Va.

Staten Island and New Jersey Channel.

Susquehanna, above and below Havre de Grace.

Thames River, Conn.

MORTON. (See SIMER & MORTON.)**MORTON, E. M., Contractor.**

Mississippi River, Des Moines Rapids to mouth of Illinois River.

MORTON, W. S., Assistant Engineer.

Mississippi River, reservoir at sources.

MOSELY & CANADA, Contractors.

Staunton River, Va.

MOUNT WALDO GRANITE COMPANY, Contractors.

Marens Hook, Del.

MUEHLE, B. H., Assistant Engineer.

Clinton River, Mich.

Saginaw River, Mich.

St. Clair River, Mich.

- MUNDY, J. S., *Contractor*.
Neuse River, N. C.
- MURPHY, F. P., *Contractor*.
Charleston Harbor, S. C.
- MURPHY, S. A., *Contractor*.
Toledo Harbor, Ohio.
- MYERS, R. J. & H. C., *Post Contractors*.
Sodus Harbor (Little), N. Y.
- NATIONAL DREDGING COMPANY, *Contractors*.
Cape Fear River, N. C., below Wilmington.
- Corsica Creek, Md.
- Currituck Sound, Coanajok Bay, and North River Bar, N. C.
- Delaware River below Bridesburg.
- Leonardtown Harbor, Md.
- Neabsco Creek, Va.
- New Castle Harbor, Del.
- Nomini Creek, Va.
- Norfolk Harbor, Va.
- Portland Harbor, Me.
- Potomac River at Mount Vernon.
- Potomac River at Washington, D. C.
- Schuylkill River, Pa.
- Urbana Creek, Va.
- Wilmington Harbor, Del.
- York River, Va.
- NEASE, H. B., *Contractor*.
Ohio River (except Falls, etc.).
- NELLES, G. T., *Assistant Engineer*.
Missouri River, from mouth to Sioux City.
- NEVELING, I., & SON, *Contractors*.
Wilmington Harbor, Del.
- NEW ENGLAND DREDGING COMPANY, *Contractors*.
Boston Harbor, Mass.
- Plymouth Harbor, Mass.
- NEWTON, A. M., *Contractor*.
Cumberland Sound, Fla. and Ga.
- New Haven Harbor, Conn.
- NEWTON, V. M., *Assistant Engineer*.
Sassafras River, Md.
- NEW YORK STEAM DREDGING COMPANY, *Contractors*.
Cape Fear River, N. C., below Wilmington.
- Delaware River below Bridesburg.
- NEYLAND & HENDERSON, *Contractors*.
Neches River, Tex.
- NIER, J. W., *Assistant Engineer*.
Missouri River, from mouth to Sioux City.
- NOBLE, A., *Assistant Engineer*.
St. Mary's River and Falls Canal.
- NOLAN & SON, *Contractors*.
Potomac River, D. C.
- NOLTY, A. J., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- NORTON, F. O., *Contractor*.
Ohio River (except Falls, etc.).
- OAKLAND DREDGING COMPANY, *Contractors*.
San Joaquin River, Cal.
- O'BRIEN & Co., *Contractors*.
Kentucky River, Ky.
- OCKERSON, J. A., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- ODIORNE, J. N., *Assistant Engineer*.
Duck Creek, Del.
- Indian River, Del.
- Mispillion, Creek, Del.
- ODIORNE, W. S., *Assistant Engineer*.
St. Jones River, Del.
- OFFICER, E. F., *Assistant Engineer*.
Arkansas River at Pine Bluff, Ark.
- OLIVER. (See DEMING & OLIVER.)
- OLIVER BROTHERS & PHILLIPS, *Contractors*.
Ohio River (except Falls, etc.).
- OREGON PAVING COMPANY, *Contractors*.
Columbia River, Oreg.
- ORLAPP, M. A., *Assistant Engineer*.
Petit Jean River, Ark.
- Red River (Little), Ark.
- Red River, La. and Ark.
- OWEN, J. W., *Contractor*.
Saginaw River, Mich.
- PACIFIC COAST AND RECLAMATION COMPANY, *Contractors*.
Wilmington Harbor, Cal.
- PACKARD, A. J., *Contractor*.
Buffalo Harbor, N. Y.
- Charlotte Harbor, N. Y.
- Chicago Harbor, Ill.
- Michigan City Harbor, Ind.
- Sodus Harbor (Great), N. Y.
- Sodus Harbor (Little), N. Y.
- Wilson Harbor, N. Y.
- PACQUIT & SMITH, *Contractors*.
Columbia River (Lower), Oreg.
- PAIGE, J. A., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- PAQUET, J., *Contractor*.
Willamette River (Upper), Oreg.
- PARDESSUS & ANTHONY, *Contractors*.
Norfolk Harbor, Va.
- PARET, M., *Assistant Engineer*.
Cheesequake and Delaware Bays.
- PARKINSON, J. B., *Assistant Engineer*.
Agate Bay, Minn.
- Minnesota River, Minn.
- Mississippi River, reservoir at sources.
- Superior Bay and St. Louis Bay, Wis.
- PARROTT, B., *Contractor*.
Passaic River, N. J., at Newark.
- Port Chester Harbor, N. Y.
- PARSONS, C. W., *Assistant Engineer*.
Choptank River, Md.
- Deal's Island, Md. (lower thoroughfare).
- Deal's Island, Md. (upper thoroughfare).
- PARSONS, G. W., *Contractor*.
Broad Creek, Del.
- Elk River, Del.
- Wicomico River, Md.
- PARSONS, N. W., *Assistant Engineer*.
Wicomico River, Md.
- PATRICK. (See LARKIN & PATRICK.)
- PATTEN, J. V., *Contractor*.
Cohansey Creek, N. J.
- Delaware River, between Trenton and Bridesburg.

- PATTERSON BROTHERS, *Contractors*.
Mississippi River, St. Paul to Des Moines Rapids.
Mississippi River, Des Moines Rapids, Canal, and Dry-Dock.
- PATTERSON, W. A. & J. C., *Contractors*.
Mississippi River, Des Moines Rapids to mouth of Illinois River.
- PAULSON. (See DICKERSON & PAULSON.)
- PAYNE, E. M., *Contractor*.
Passaic River, N. J., below Newark.
New London Harbor, Conn.
Newport Harbor, R. I.
- PEARLE, J. W., *Assistant Engineer*.
Missouri River, from Mouth to Sioux City.
Nishnabotana River, Iowa.
- PEARSONS, G. W., *Assistant Engineer*.
Broad Creek, Del.
- PEASE, C. S., *Assistant Engineer*.
Missouri River, from mouth to Sioux City.
- PEELER, H. A., *Contractor*.
Bayou Terrebonne, La.
- PECK, W. A., *Assistant Engineer*.
Milford Harbor, Conn.
New Haven Harbor, Conn.
- PENCE, W. L., *Contractor*.
Kentucky River, Ky.
- PENN, E. G., *Contractor*.
Ohio River (except Falls, etc.).
- PENNY, H. H., *Contractor*.
Charleston Harbor.
- PENNYPACKER. (See ROSS & PENNYPACKER.)
- PERCY, C. B., *Assistant Engineer*.
Cohaba River, Ala.
Dauphin Island and Cedar Point.
- PERRY, A. R., *Contractor*.
Tennessee River above and below Chattanooga.
- PETER. (See SCULLY & PETER.)
- PETITIDIER, L. M., *Assistant Engineer*.
Monongahela River, Pa. and W. Va.
- PETITIDIER, O. L., *Assistant Engineer*.
New Buffalo Harbor, Mich.
Wabash River, Ind.
White River, Ind.
- PETRIE, A. H., *Contractor*.
Muskegon Harbor, Mich.
St. Joseph Harbor, Mich.
- PETRIE, A. H., & Co., *Contractors*.
Chicago Harbor, Ill.
- PHIFFER, C. W., *Assistant Engineer*.
Big Sunflower River, Miss.
- PHILLIPS. (See OLIVER BROTHERS & PHILLIPS.)
- PHILLIPS, H. W., *Contractor*.
Boston Harbor, Mass.
Scituate Harbor, Mass.
- PICTON, J. M., *Assistant Engineer*.
Brazos River, Tex.
Mattagorda Bay, Tex.
- PIDGEON, F., *Contractor*.
Delaware River below Bridesburg.
Duck Creek, Del.
Mispillion Creek, Del.
New Castle, Del.
Norwalk Harbor, Conn.
Passaic River, N. J., above Newark.
- PIDGEON, F.—Continued.
Schuylkill River, Pa.
Wareham Harbor, Mass.
- PIDGEON, J. & F., *Contractors*.
Mattawan Creek, N. J.
- PIDGEON HILL GRANITE COMPANY, *Contractors*.
Sandy Bay, Mass.
- PIDGEON, M. K., *Contractor*.
Port Chester Harbor, N. Y.
- PIERPONT, J., *Assistant Engineer*.
Wolf River, Wis.
- PITTSBURGH BRIDGE COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- POLHEMUS, J. S., *Assistant Engineer*.
Neches River, Tex.
Sabine River, La. and Tex.
Siulaw Bay, Oreg.
Umpqua River, Oreg.
Yaquina Bay, Oreg.
- POPE, W. S., *Contractor*.
St. Mary's River and Falls Canal.
- PORTERFIELD, W., *Assistant Engineer*.
Big Black River, Miss.
- PORTER, TUCKER & MAHAN, *Contractors*.
Kanawha River (Great), W. Va. (harbor of refuge).
Ohio River (except Falls, etc.).
- PORTSMOUTH FOUNDRY AND MACHINE WORKS, *Contractors*.
Kanawha River (Little), W. Va.
- POST, J. C., *Assistant Engineer*.
Altamaha River, Ga.
Salkiehatchee River, S. C.
- POST & HENDERSON, *Contractors*.
Oswego, N. Y.
- POTOMAC DREDGING COMPANY, *Contractors*.
Leonardtown Harbor, Md.
Potomac River at Washington, D. C.
Urbana Creek, Va.
- POTOMAC RED SANDSTONE COMPANY, *Contractors*.
Potomac River, D. C.
- POTTER, A. S., *Assistant Engineer*.
Missouri River, from mouth to Sioux City.
- POTTER, T., *Contractor*.
Baltimore Harbor, Md.
- POWELL, A. O., *Assistant Engineer*.
Chippewa River, Wis.
Chippewa River at Yellowbank, Wis.
- POWLESS, W. H., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- PRATT, C. M., *Contractor*.
Flushing Bay, N. Y.
- PRATT & Co., *Contractors*.
Buffalo Harbor, N. Y.
- PRICE. (See STRATHAM & PRICE.)
- PRICE, H. F., *Assistant Engineer*.
Beaufort Harbor, N. C.
- PRICE, W. G., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- PRYSE, E. M., & BROTHER, *Contractors*.
Kentucky River, Ky.
- PURINGTON, S. F., *Contractor*.
Richmond Harbor, Me.

- QUEEN CITY BRIDGE AND STEAM FORGING COMPANY, *Contractors*.
Ohio River (except Falls, etc.).
- QUINN, C., *Assistant Engineer*.
Bayou Bartholemew, Ark. and La.
Bayou Bœuf, La.
- QUINN, O. J., *Contractor*.
Saginaw River, Mich.
- RALEY, W. P., *Contractor*.
Eagle Harbor, Mich.
- RAMSEY, H. A., & Co., *Contractors*.
Ohio River (except Falls, etc.).
- RAND & BURGER, *Contractors*.
Port Washington Harbor, Wis.
- RANSOM, R., *Assistant Engineer*.
Beaufort Harbor, N. C.
Contentnea Creek, N. C.
New Berne to Beaufort, N. C.
Trent River, N. C.
- RASER, G. B., *Contractor*.
Ashtabula Harbor, Ohio.
- RAUCHENSTEIN, R., *Assistant Engineer*.
Pascagoula River, Miss.
Wacissa and Aucilla rivers, Fla.
- RAYMOND, T. L., *Assistant Engineer*.
Calcasieu River, La.
Sabine Pass, Tex.
- RAYNOLDS, J. D., *Assistant Engineer*.
Mississippi River, reservoir at sources.
- RECORD, J. R., *Assistant Engineer*.
Mississippi River, between mouths of Illinois and Ohio rivers.
- REES, J., *Contractor*.
Missouri River, between Kansas City and the mouth.
- REES, N. M., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
Red River, La.
Yalabusha River, Miss.
- RENDROCK POWDER COMPANY, *Contractors*.
East River, N. Y.
- REYNOLDS, W. C., *Assistant Engineer*.
Coal River, W. Va.
- RHODES, C. D., *Assistant Engineer*.
Mokelumne River, Cal.
- RICH, J., *Contractor*.
Ontonagon Harbor, Mich.
- RICHARDSON, W., *Contractor*.
Monroe Harbor, Mich.
Sandusky City Harbor, Ohio.
Sandusky River, Ohio.
- RIGHTMAN, A., *Contractor*.
Mississippi River, St. Paul to Des Moines Rapids.
- RIGHTMAN, J., *Contractor*.
Mississippi River, St. Paul to Des Moines Rapids.
- RIDDELL. (See KEPPERS & RIDDELL.)
- RILEY, J. L., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- RIMBARK, S. D., *Contractor*.
Oconto Harbor, Wis.
- RIPLEY, H. C., *Assistant Engineer*.
Brazos River, Tex.
Brazos Santiago Harbor, Tex.
Port Brown, Tex.
Galveston Harbor, Tex.
- RIPLEY, H. C.—Continued.
Matagorda Bay, Tex.
- RITTER, H. P., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- ROBERTS, T. P., *Assistant Engineer*.
Allegheny River, Pa.
- ROBERTS, W. M., & Co., *Contractors*.
Mississippi River, St. Paul to Des Moines Rapids.
- ROBINSON, P., *Assistant Engineer*.
Aucilla and Wacissa rivers, Fla.
Crystal River, Fla.
Manatee River, Fla.
Ocklockonee River, Fla.
- ROBINSON, P., *Contractor*.
Finnhalloway River, Fla.
- ROCKPORT AND PIDGEON HILL GRANITE COMPANY, *Contractors*.
Sandy Bay, Mass.
- RODDIN, J., *Contractor*.
New Haven Harbor, Conn.
- ROESSLER, S. W., *Assistant Engineer*.
Colorado River, Cal.
- ROGERS, F. P., *Assistant Engineer*.
Hudson River, N. Y.
- ROHERER, J. B., *Assistant Engineer*.
Bay River, Ark.
St. Francis River, Ark. and Mo.
- ROONEY. (See FRENCH & ROONEY.)
- ROONEY, JAMES, JR., *Contractor*.
Black River Harbor, Ohio.
- ROONEY, J., *Contractor*.
Erie (Presque Isle) Harbor, Pa.
- ROONEY, W. E., *Contractor*.
Fairport Harbor, Ohio.
Toledo Harbor, Ohio.
- ROSS. (See BURNETT & ROSS.)
- ROSS. (See LARA, ROSS & Co.)
- ROSS, P. S., *Contractor*.
Flushing Bay, N. Y.
Norfolk Harbor, Va.
Passaic River, N. J., below Newark.
Potomac River, Washington, D. C.
Romerly Marsh, Ga.
Savannah River above and below Augusta.
Wicomico River, Md.
- ROSS & LARA, *Contractors*.
Cape Fear River, N. C., below Wilmington.
- ROSS & PENNYPACKER, *Contractors*.
Cape Fear River, N. C., below Wilmington.
- ROSS & SANFORD, *Contractors*.
Wappoo Cnt, S. C.
- ROSS & SANFORD DREDGING COMPANY, *Contractors*.
Ashley River, S. C.
- ROUTH, J. S., *Contractor*.
Ohio River (except Falls, etc.).
- ROWE, T. A., *Contractor*.
Newburyport Harbor, Mass.
Rockland Harbor, Me.
- RUHL, E., *Assistant Engineer*.
Etowah River, Ga.
- RUPLE, C. P., *Assistant Engineer*.
Mississippi River, between mouth of Ohio River and Head of Passes.
- RUSSELL. (See EPHINGER & RUSSELL.)

SACKETT, J. W., *Assistant Engineer*.
Keyport Harbor, N. J.
Tampa Bay, Fla.

SAGER, G. H., *Contractor*.
Kenosha Harbor, Wis.
Racine Harbor, Wis.

SAGUE, S. A., *Contractor*.
Port Clinton Harbor, Ohio.

ST. L. COPPER, H., *Assistant Engineer*.
Grand Gulf, Miss.
Mississippi River, between mouth of
Ohio River and Head of Passes.
Red River, La.

SALEM STONE AND LIME COMPANY, *Con-
tractors*.
Ohio River, Falls of.

SALMON & MARES, *Contractors*.
Port Clinton Harbor, Ohio.

SAMO, T. B., *Assistant Engineer*.
Washington Aqueduct, D. C.

SAMPLE, S., *Contractor*.
Mississippi River, Des Moines Rapids to
mouth of Illinois River.

SANBORN, W. G., *Assistant Engineer*.
Holston River, Tenn. and Va.
Powell River, Va. and Tenn.

SANFORD. (See ROSS & SANFORD.)

SANFORD, J. C., *Assistant Engineer*.
Glen Cove Harbor, N. Y.

SANGER & MOODY, *Contractors*.
Illinois River.

SAVAGE, J. E., *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.

SAWYER. (See HAMILTON & SAWYER.)

SCAIFE POUNDRY AND MACHINE COM-
PANY, *Contractors*.
Ohio River (except Falls, etc.).

SCANDLON. (See SYMMES & SCANDLON.)

SCHERMERHORN, L. Y., *Assistant Engi-
neer*.
Ahnapee Harbor, Wis.
Ashland Harbor, Wis.
Bayfield Harbor, Wis.
Cedar River, Mich.
Grand Marais, Harbor of Refuge.
Green Bay Harbor, Wis.
Kewaunee Harbor, Wis.
Manistique Harbor, Mich.
Manitowoc Harbor, Wis.
Oconto Harbor, Wis.
Pensaukee Harbor, Wis.
Plattsburgh Harbor, N. Y.
Portage Lake and Lake Superior Ship
Canal.
Salmon River, N. Y.
Sheboygan Harbor, Wis.
Sturgeon Bay Canal, Wis.
Swanton Harbor, Vt.
Two Rivers Harbor, Wis.
Compiler on this Index. (See Preface,
Vols. I and II.)

SCHMIDT, M. E., *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.

SCHOPP, P. J., *Assistant Engineer*.
Ohio River (except Falls, etc.).
Ohio River, Falls of.

SCHROEDER. (See TRUMAN & SCHROE-
DER.)

SCHWARZ & BERNER, *Contractors*.
Cedar River, Mich.
Kewaunee Harbor, Wis.
Muskegon Harbor, Mich.
Oconto Harbor, Wis.
Portage Lake, Mich.

SCOTT, A. M., *Assistant Engineer*.
Elk River, W. Va.

SCOTT, G. V., & SONS, *Contractors*.
Appomattox River, Va.

SCOVE. (See HANSON & SCOVE.)

SCULLY, J., *Contractor*.
Block Island Harbor, R. I.
Nantucket Harbor, Mass.
Port Jefferson Harbor, N. Y.

SCULLY & PETER, *Contractors*.
Kentucky River, Ky.

SEAGER, J. L., *Assistant Engineer*.
Broad Creek, Del.
Cherrystone Creek, Va.
Dividing Creek, Md.
Hunting Creek, Va.
Nanticoke River, Del. and Md.
Pocomoke River, Md.
Pungoteague Creek, Va.
Tuckahoe Creek, Md.

SEARLES, J. M., *Assistant Engineer*.
Big Sunflower River, Miss.

SEDDON, J. A., *Assistant Engineer*.
Missouri River, mouth to Fort Benton.

SEDGWICK, T. S., *Assistant Engineer*.
Araucarias Pass and Bay, Tex.

SEWARD, E. R., *Contractor*.
New Rochelle Harbor, Conn.

SEWARD, J. M., *Contractor*.
Housatonic River, Conn.
Milford Harbor, Conn.
Port Jefferson Harbor, N. Y.
Southport Harbor, Conn.

SEWICKLEY LUMBER COMPANY, *Contract-
ors*.
Ohio River (except Falls, etc.).

SEYMER, C. P., *Contractor*.
Tangipahoa River, La.

SHADBOLT, BOYD & CO., *Contractors*.
Green Bay Harbor, Wis.

SHANKLAND, E. C., *Assistant Engineer*.
Missouri River, from mouth to Sioux
City.

SHANNON, A. M., & Co., *Contractors*.
Araucarias Pass and Bay, Tex.
Galveston Harbor, Tex.
Matagorda Bay, Tex.

SHANNON & HYATT, *Contractors*.
Galveston Harbor, Tex.

SHAW, E. P., *Contractor*.
Newburyport Harbor, Mass.

SHAW, G. W., *Assistant Engineer*.
Ohio River, Falls of.

SHERWOOD, W. H., & Co., *Contractors*.
Ohio River (except Falls, etc.).

SHERWOOD, STRIEBERGER & GEISSEN-
DORFER, *Contractors*.
Cleveland Harbor, Ohio.

SHIELS, T., *Assistant Engineer*.
Duluth Harbor, Minn.

SHIPLEY, D. B., *Assistant Engineer*.
Big Sandy River, W. Va. and Ky.

SHIPMAN & CARMODY, *Contractors*.
Mouongahela River, Pa. and W. Va.

- SHIPMANS, J. J., *Contractor*.
 Kanawha River (Great), W. Va., Har-
 bor of Refuge.
 Ohio River (except Falls, etc.).
 SIDDON, W. L., *Assistant Engineer*.
 Mississippi River, between mouth of
 Ohio River and Head of Passes.
 SIMAR, V. D., *Assistant Engineer*.
 Chippewa River, Wis.
 St. Croix River, Wis. and Minn.
 SIMAR & MORTON, *Contractors*.
 Chippewa River, Wis.
 SIMPSON, W. S., *Assistant Engineer*.
 Osage River, Mo. and Kans.
 SIMS, J., *Contractor*.
 Vermillion Harbor, Ohio.
 SINGER & TALCOT STONE COMPANY, *Con-
 tractors*.
 Chicago Harbor, Ill.
 SKILDON. (See HUBBLE & SKILDON.)
 SKINNER, J. D., *Assistant Engineer*.
 Mississippi River, reservoir at sources.
 SLAUGHTER, J. E., *Contractor*.
 Cedar Keys Harbor, Fla.
 Galveston Bay (Ship Canal), Tex.
 Suwanee River, Fla.
 Tampa Bay, Fla.
 SLAUGHTER, P. M., *Contractor*.
 Flint River, Ga.
 SMITH. (See LEATHERN & SMITH.)
 SMITH. (See PACQUIT & SMITH.)
 SMITH, A. D., *Contractor*.
 Portland Harbor, Me.
 SMITH, E. A., *Assistant Engineer*.
 Black Warrior River from Tinscaloosa to
 Daniels Creek, Ala. and Miss.
 SMITH, F. (See SMITH, G. W. & F.)
 SMITH, F. A., *Contractor*.
 Pamunkey River, Va.
 SMITH, F. H., *Contractor*.
 Housatonic River, Conn.
 New Haven Harbor, Conn.
 Pensacola Harbor, Fla.
 SMITH, G. W. & F., *Contractors*.
 Sandy Bay, Mass.
 SMITH, J. A. (See SMITH, L. P. &
 J. A.)
 SMITH, J. B. & Co., *Contractors*.
 Muskegon Harbor, Mich.
 White River Harbor, Mich.
 SMITH, J. G., *Contractor*.
 St. Augustine Creek, Ga.
 SMITH, L. P., *Contractor*.
 Fairport Harbor, Ohio.
 SMITH, L. P. & J. A., *Contractors*.
 Ashtabula Harbor, Ohio.
 Cleveland Harbor, Ohio.
 Huron Harbor, Ohio.
 Saginaw River, Mich.
 Sandusky River, Ohio.
 Vermillion Harbor, Ohio.
 SMITH, P., *Contractor*.
 Cleveland Harbor, Ohio.
 SMITH, S. R., *Contractor*.
 Clearwater River, Idaho.
 SMITH, T. H., *Contractor*.
 Ludington Harbor, Mich.
 Pentwater Harbor, Mich.
 SMITH, T. W., *Contractor*.
 Potomac River, D. C.
- SMITH, W. F., *U. S. Agent*.
 Assateague Bay, Md.
 Broad River, Del.
 Broadkill River, Del.
 Cambridge Harbor, Md.
 Chester River, Md.
 Chincoteague Bay, Md.
 Choptank River, Md.
 Corsica Creek, Md.
 Deal's Island (upper thoroughfare), Md.
 Duck Creek, Del.
 Easton Point Harbor, Md.
 Elk River, Md.
 Fairlee Creek, Md.
 Indian River, Del.
 Lewis Creek, Del.
 Maurice River, N. J.
 Mispillion Creek, Del.
 Nanticoke River, Del.
 New Castle (ice-harbor), Del.
 Pocomoke Sound, Md.
 Rehoboth Bay, Del.
 St. Jones River, Del.
 Sassafras River, Md.
 Skipton Creek, Md.
 Susquehanna River above and below
 Havre de Grace, Md.
 Tuckahoe Creek, Md.
 Water-way between Chincoteague and
 Delaware bays, Md.
 Wicomico River, Md.
 Wilmington Harbor, Del.
 SMITH, W. P., *Assistant Engineer*.
 Easton Point Harbor, Md.
 Greenbriar River, W. Va.
 New Castle Harbor, Del.
 Sacramento and Feather rivers, Cal.
 San Joaquin Harbor, Cal.
 Wilmington Harbor, Cal.
 SNEAD & CO. IRON-WORKS, *Contractors*.
 Kanawha River (Great), W. Va.
 SOMERS, F. C., *Contractor*.
 Chester and Ridley Creek, Pa.
 Cohansey Creek, N. J.
 Elizabeth River, N. J.
 Indian River, Del.
 Nanticoke River, Del. and Md.
 Potomac River, D. C.
 SOULE. (See HAMILTON & SOULE.)
 SOUTHERLAND, C., *Contractor*.
 Au Sable River and Harbor, Mich.
 Grand Marais Harbor of Refuge, Mich.
 Saginaw River, Mich.
 SPALDING, E. M., *Assistant Engineer*.
 Superior and St. Louis bays, Wis.
 SPECT, J., *Contractor*.
 Mississippi River, Des Moines Rapids
 to mouth of Illinois River.
 SPICER, R. M., *Assistant Engineer*.
 Bayou Bartholomew, Ark. and La.
 SPRAGUE, S. G., *Contractor*.
 Muskingum River (ice-harbor), Ohio.
 SPRINGER, J. C., *Contractor*.
 Cape Fear River, N. C., below Wilming-
 ton.
 SQUIRE & WHITE, *Contractors*.
 Grand Haven Harbor, Mich.
 Grand River, Mich., below Grand
 Rapids.
 Pentwater Harbor, Mich.

SQUIRE & WHITE—Continued.

- South Haven Harbor, Mich.
STANG. (See **KERR, STANG & GILLMORE.**)
STANG, J., Contractor.
 Black River Harbor, Ohio.
 Cleveland Harbor, Ohio.
 Huron Harbor, Ohio.
 Port Clinton Harbor, Ohio.
STANG & GILLMORE, Contractors.
 Black River Harbor, Ohio.
 Huron Harbor, Ohio.
 Sandusky City Harbor, Ohio.
STANTON, J. P., Contractor.
 New Haven Harbor, Conn.
STANTON, W. P., Contractor..
 Cleveland Harbor, Ohio.
STANTON & DOYLE, Contractors.
 Hudson River, N. Y., between Baltimore and Troy.
STARKE, C. H., Contractor.
 Milwaukee Bay, Wis.
STARK, SMITH & Co., Contractors.
 Milwaukee Harbor, Wis.
STARKWEATHER, W. J., Contractor.
 Fairport Harbor, Ohio.
STAER, W. W., Assistant Engineer.
 Channel between Lloyd Harbor and Cold Springs, N. Y.
STEEL BROTHERS & Co., Contractors.
 Agate Bay, Minn.
STEFFEN, J. F., Contractor.
 Columbia River, Oreg.
STEPHENSON, S. M., Contractor.
 Monomouee Harbor, Mich. and Wis.
STEVENS. (See **ARNOLD & STEVENS.**)
STEVENS, H. E., Contractor.
 Lake Pepin, Mississippi River.
STEVENS, S. D., Contractor.
 Sacramento and Feather rivers, Cal.
STEWART, H., Assistant Engineer.
 Bayou La Fourche, La.
STEWART, J. M., Assistant Engineer.
 Delaware Breakwater, Del.
 Lewes Harbor, Del.
 St. Jones River, Del.
STEWART, N., Assistant Engineer.
 Mississippi River, between mouth of Ohio River and Head of Passes.
STIERLE, A., Assistant Engineer.
 Delaware Bay, ice-harbor at head of.
 Delaware Breakwater, Del.
 Delaware River.
 Frankford Creek, Pa.
 Lewes Harbor, Del.
 Mantua Creek, N. J.
 Maurice River, N. J.
 Raccoon River, N. J.
 Rancocas River, N. J.
 Salem River, N. J.
 Susquehanna River, Pa.
 Woodbury Creek, N. J.
SROCK, H. T., Contractor.
 Sand Beach, Mich.
STOLL, C. F., Contractor.
 Port Jefferson Harbor, N. Y.
STONE, R., Assistant Engineer.
 East River, N. Y.
STONE, R., Contractor.
 New York Harbor (Godney's and main ship-channel.)

STOVER, J., Contractor.

- Sand Beach, Mich.
STRATHAM & PRICE, Contractors.
 Kentucky River, Ky.
STRIEBERGER. (See **SHERWOOD, STRIEBERGER & GEISSENDORFER.**)
STRING, J., Contractor.
 Port Clinton Harbor, Ohio.
STROHMAN, R., Assistant Engineer.
 Alpena Harbor (Thunder Bay), Mich.
STRONG, C. H., & SON, Contractors.
 Kanawha River (Great), W. Va.
STRONG, H. B., Contractor.
 Erie (Presque Isle) Harbor, Pa.
STRONG, W. E., Assistant Engineer.
 Kanawha River (Little), W. Va.
STUBBS & CACKAY, Contractors.
 Ohio River (except Falls, etc.).
SUBLETT, D. L., Assistant Engineer.
 Chattahoochee River, Ga. and Ala.
 Duck River, Tenn.
 Kentucky River, Ky.
SULLIVAN. (See **DUNBAR & SULLIVAN.**)
SULLIVAN, D. F., Contractor.
 Pensacola Harbor, Fla.
SUMMER, J. T., Contractor.
 Potomac River, D. C.
SUMMERELL, G. M., Contractor.
 Cape Fear River, N. C., below Wilmington.
SUTHERLAND, C., Contractor.
 Charlevoix Harbor, Mich.
SWEENEY. (See **HOLMES & SWEENEY.**)
SWEENEY, M. A., Contractor.
 Ocmulgee River, Ga.
SWEENEY, M. A., & BROTHERS, Contractors.
 Oconee River, Ga.
 Ohio River, Falls of.
 Tennessee River above and below Chattanooga.
SWIFT, A. J., Assistant Engineer.
 Wilmington Harbor, Cal.
SYLVESTER, I. A., Contractor.
 Providence River and Narragansett Bay.
 Wood's Holl Harbor, Mass.
SYLVESTER, R. C., Contractor.
 Newburyport Harbor, Mass.
SYMMES & SCANDLON, Contractors.
 Toledo Harbor, Ohio.
SYMONDS, T., Contractor.
 Coheco River, N. H.
 Exeter River, N. H.
 Ipswich River, Mass.
 Lamprey River, N. H.
 Saco River, Me.
 York Harbor, Me.
TAFT, C. E., Assistant Engineer.
 Arkansas River, from Little Rock to mouth.
TALBOT, G., Contractor.
 Erie (Presque Isle) Harbor, Pa.
 Saginaw River, Mich.
 Sand Beach, Mich.
 Toledo Harbor, Ohio.
TALCOT. (See **SINGER & TALCOT.**)
TALCOT, R. H., Assistant Engineer.
 Bergen Neck, N. J. (Ship canal.)
 Bronx River, N. Y.
 Cheesapeake Creek, N. J.

- TALCOT, R. H.—Continued.
Cornell's Landing and Jamaica Bay,
N. Y.
Gowanus Bay, N. Y.
Hempstead Harbor and Bay, N. Y.
New Rochelle Harbor, N. Y.
Patchogue River, N. Y.
South River, N. J.
Sumpawanus Inlet, N. Y.
- TALLANT MARBLE COMPANY, *Contractors*.
Des Moines Rapids, Canal, and Dry-
Dock, Mississippi River.
- TAYLOR, B. T., *Assistant Engineer*.
Buffalo Bayou, Tex.
- TAYLOR, J., *Contractor*.
Potomac River, D. C.
- TAYLOR, T. H., *Assistant Engineer*.
Ohio River, Falls of.
- TAYLOR, W. D., *Contractor*.
Pultneyville Harbor, N. Y.
Sodus Harbor (Little), N. Y.
Wilson Harbor, N. Y.
- TEAGUE, S., *Contractor*.
Newburyport Harbor, Mass.
- TERKELSON, J. (See LORENZ & TERKELSON.)
- TERKELSON. (See TILFORD & TERKELSON.)
- TERRY, F., *Assistant Engineer*.
Mississippi River, above Falls of St. Anthony.
- THAYER, J. E., *Contractor*.
Kanawha River (Great), W. Va.
- THAYER, O. A. & W. T., *Contractors*.
Kanawha River (Great), W. Va.
- THOMAS, B. F., *Assistant Engineer*.
Big Sandy River, W. Va. and Ky.
- THOMAS, S. T., & BLUNDON, J. A., *Contractors*.
Potomac River, D. C.
- THOMLINSON, J., *Contractor*.
Apalachicola Bay, Fla.
- THOMPS N, E. D., *Assistant Engineer*.
Beaufort Harbor and New River, N. C.
Mississippi River, between mouth of
Ohio River and Head of Passes.
New Berne to Beaufort, N. C.
New River, N. C.
Pamlico and Tar River, N. C.
Trent River, N. C.
Yadkin River, N. C.
- THOMPSON, J. B., *Contractor*.
Ohio River (except Falls, etc.).
- THOMPSON, T. K., *Contractor*.
Galveston Harbor, Tex.
- TILFORD & TERKELSON BROTHERS, *Contractors*.
Wilmington Harbor, Cal.
- TOLLINGER, E. C., *Assistant Engineer*.
Clinch River, Tenn. and Va.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- TOMS, W. A., *Assistant Engineer*.
Tennessee River above and below Chat-
tanooga.
- TOWAR, F. M., *Assistant Engineer*.
Yazoo River, Miss.
- TOWARS, A., *Contractor*.
St. Clair River, Me.
- TOWNSEND, G. W., *Contractor*.
Bath Harbor, Me.
Boston Harbor, Mass.
Echo Harbor, New Rochelle, N. Y.
Lubec Channel, Me.
Merrimac River, Mass.
Portsmouth Harbor, N. H.
Sandy Bay, Mass.
Taunton River, Mass.
Wood's Holl Harbor, Mass.
- TOWNSEND, T. B., *Contractor*.
Kanawha River (Little), W. Va.
Muskingum River (ice-harbor), Ohio.
- TOWNSEND & TRUMBALL, *Contractors*.
Delaware River at Schooner Ledge.
- TRUAX, S. J., *Contractor*.
Mississippi River, St. Paul to Des Moines
Rapids.
- TRUK, C. S., *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- TRUMAN & COOPER, *Contractors*.
Manitowoc Harbor, Wis.
Menomonee Harbor, Mich. and Wis.
Portage Lake Harbor, Mich.
Port Washington Harbor, Wis.
Sheboygan Harbor, Wis.
Two Rivers Harbor, Wis.
- TRUMAN & SCHROEDER, *Contractors*.
Sturgeon Bay Canal, Wis.
- TRUMBALL. (See TOWNSEND & TRUMBALL.)
- TRUMBULL & CHENEY, *Contractors*.
Merrimac River, Mass.
- TUCKER. (See PORTER, TUCKER & MAHAN.)
- TUCKER, N. W., *Contractor*.
Ohio River (except Falls, etc.).
- TURRILL, C. A., *Assistant Engineer*.
Cumberland River above Nashville.
Red River, Tenn.
- TURTLE, J. E., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- TUTTLE, F. W., *Assistant Engineer*.
Red River (Little), Ark.
- TWINING, E. H., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- UNITED STATES DREDGING COMPANY, *Contractors*.
Buttermilk Channel, N. Y.
- UPHAM. (See WILLIAMS & UPHAM.)
- VALENTINE, T., *Assistant Engineer*.
Delaware River.
Schuylkill River, Pa.
Wilmington Harbor, Del.
- VAN BUSKIRK, J., *Contractor*.
Sand Beach, Mich.
- VANCE, H., *Assistant Engineer*.
Bayou Pierre, La.
Red River, La. and Ark.
- VANDERWERKEN, G., *Contractor*.
Potomac River, D. C.
- VAN GORDER. (See JENKINS & VAN GORDER.)
- VAN PATTEN, J., *Contractor*.
Mattawan Creek, N. J.
Northeast River, Md.
Rahway River, N. J.

- VAN PATTEN, J.—Continued.
 Raritan River, N. J.
 Susquehanna River, Pa.
 Woodbridge Creek, N. J.
- VENDLE, M. W., *Assistant Engineer*.
 Kanawha River (Little), W. Va.
- VOIGT, E. T., *Assistant Engineer*.
 Columbia River (Upper) and Snake
 River, Oreg. and Wash.
- VON HEIN, M., *Contractor*.
 Mississippi River, Des Moines Rapids to
 mouth of Illinois River.
- VON SCHMIDT, A. W., *Contractor*.
 Oakland Harbor, Cal.
 Wilmington Harbor, Cal.
- VON SCHMIDT, E. A., *Contractor*.
 Wilmington Harbor, Cal.
- VON SCHMIDT & MCNEE, *Contractors*.
 Oakland Harbor, Cal.
 San Joaquin Harbor, Cal.
- VOSBURGH, M. S., *Contractor*.
 Olcott Harbor, N. Y.
 Wilson Harbor, N. Y.
- WALSH & HANNAH, *Contractors*.
 Calumet Harbor, Ill.
- WALTER, J. E., *Contractor*.
 Brunswick Harbor, Ga.
 Savannah River between Savannah
 and Augusta.
- WALTER & DARRAH, *Contractors*.
 Ohio River (except Falls, etc.).
- WANZER, C., *Assistant Engineer*.
 Mississippi River, reservoir at sources.
 Red River of the North, Minn. and
 Dak.
- WARD, C. D., *Assistant Engineer*.
 Canal (ship) from Lake Erie to the
 Wabash and Ohio rivers.
- WARD, G. E., *Contractor*.
 Currituck Sound, Coanajok Bay, and
 North River Bar, N. C.
 James River, Va.
 St. Jerome's Creek, Md.
- WARD, G., and MCKENZIE, A. F., *Con-
 tractors*.
 Erie (Presque Isle) Harbor, Pa.
- WARREN, A., *Assistant Engineer*.
 Missouri River, from mouth to Fort
 Benton.
- WARREN, R. W., *Contractor*.
 East River, N. Y.
- WATSON, R., *Contractor*.
 Columbia River, Oreg., Willamette
 and California rivers below Port-
 land.
- WEBB, W. L., *Assistant Engineer*.
 Aransas Pass and Bay, Tex.
 Galveston and Brazos River, Tex.
 Trinity River, Tex.
- WELLMAN, D. W., *Assistant Engineer*.
 Missouri River, from mouth to Fort
 Benton.
- WELLS, G., *Assistant Engineer*.
 Chippewa River, Wis.
 Duluth Harbor, Minn.
 Superior Bay and St. Louis Bay, Wis-
 consin.
- WEST, C. F., *Assistant Engineer*.
 Mississippi River, between mouths of
 Illinois and Ohio rivers.
- WEST LEBANON ROLLING MILL COMPANY,
Contractors.
 Kanawha River (Great), W. Va.
- WEST POINT ENGINE AND MACHINE
 COMPANY, *Contractors*.
 Appomattox River, Va.
- WEST, S., *Contractor*.
 Appomattox River, Va.
- WESTON, W., *Assistant Engineer*.
 Muskingum River, Ohio.
- WHEELER, E. S., *Assistant Engineer*.
 St. Mary's River and Falls Canal.
- WHEELER, L. L., *Assistant Engineer*.
 Mississippi River, between mouth of
 Ohio River and Head of Passes.
- WHEELER, O. B., *Assistant Engineer*.
 Cross Village Harbor, Mich.
 Missouri River, from mouth to Fort
 Benton.
 Pine River, Mich.
 St. Clair River, Mich.
- WHINERY, S., *Assistant Engineer*.
 Canal connecting the headwaters of
 the Hiawasse, Tenn., and Savannah
 rivers.
- WHITCOMB, H. D., *Contractor*.
 James River, Va.
- WHITE. (See SQUIER & WHITE.)
- WHITE, D., *Assistant Engineer*.
 Lake Champlain (channel, etc.).
 Ticonderoga River, N. Y.
- WHITE, E. F., *Assistant Engineer*.
 Red River, La. and Ark.
 Trenton Harbor, La.
- WHITE, G. W., *Contractor*.
 Dunkirk Harbor, N. Y.
- WHITE, J. H., *Contractor*.
 Hyannis Harbor (breakwater), Mass.
 Provincetown Harbor, Mass.
- WHITE, W. S., *Contractor*.
 Lubec Channel, Me.
- WHITFORD, R., *Assistant Engineer*.
 Congaree River, S. C.
 Contentnea Creek, N. C.
 Georgetown Harbor, S. C.
 Pee Dee River (Great), N. C.
 Waccamaw River, N. C.
 Wateree River, S. C.
 Winyaw Bay, S. C.
- WHITING, L., *Contractor*.
 Otter Creek, Vt.
- WHITNEY, A. J., *Contractor*.
 Dubuque (ice-harbor), Iowa.
- WHITNEY, L., *Contractor*.
 Burlington Harbor, Vt.
 Lake Champlain, N. Y.
 Ticonderoga River, N. Y.
- WHITNEY & SONS, *Contractors*.
 Galena River and Harbor, Ill.
 Mississippi River, Des Moines Rapids to
 mouth of Illinois River.
 Mississippi River, St. Paul to Des Moines
 Rapids.
- WILEY, E. C., *Assistant Engineer*.
 Saline River, Ark.
- WILLARD, J. E., *Assistant Engineer*.
 Tennessee River above and below Chat-
 tanooga.
- WILLIAMS, C. E., *Contractor*.
 Buffalo Harbor, N. Y.

- WILLIAMS, E. H., *Contractor*.
Connecticut River below Hartford,
Conn.
- WILLIAMS, F. C. (See WILLIAMS & LEY-
TEN.)
- WILLIAMS, J. C., *Contractor*.
Cleveland Harbor, Ohio.
- WILLIAMS, M., *Contractor*.
Kentucky River, Ky.
- WILLIAMS, T., *Contractor*.
Oakland Harbor, Cal.
- WILLIAMS, T. H., *Contractor*.
San Joaquin River, Cal.
- WILLIAMS, W. S., *Assistant Engineer*.
Canal (ship) from Lake Erie to the
Wabash and Ohio rivers.
- WILLIAMS & LEYTE, *Contractors*.
Kanawha River (Great), W. Va.
- WILLIAMS & UPHAM, *Contractors*.
Duluth Harbor, Minn.
Grand Marais Harbor, Minn.
St. Mary's River and Falls Canal.
Superior Bay and St. Louis Bay, Wis.
- WILLIAMS, WHITE & CO., *Contractors*.
Illinois River, Ill.
- WILLIAMSON, W. G., *Assistant Engineer*.
Altamaha River, Ga.
Charlotte Harbor, Fla. (Water-way to
St. John's River.)
St. John's River.
- WILSON. (See FINLEY, GARRET & WIL-
SON.)
- WILSON, A. D., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- WILSON, A. O., *Assistant Engineer*.
Bayou Plaquemine, La.
- WILSON, C. M., *Contractor*.
Grand Marais Harbor, Minn.
- WILSON, F., *Contractor*.
Ashtabula Harbor, Ohio.
Buffalo Harbor, N. Y.
Oswego Harbor, N. Y.
Port Clinton Harbor, Ohio.
- WILSON, H., *Contractor*.
Potomac River, D. C.
- WILSON, H. C., *Assistant Engineer*.
Tchula Lake, Miss.
Tensas River and Bayou Macon.
- WILSON, J. L., *Contractor*.
James River, Va.
- WINCHELL, C. M., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- WING. (See DEWAR & WING.)
- WINNIPISOGEE LAKE MANUFACTURING
COMPANY, *Contractors*.
Lake Winnipisogee, N. H.
- WINSTON, K., *Assistant Engineer*.
Osage River, Mo. and Kans.
- WISNER, G. Y., *Assistant Engineer*.
Hennepin Canal.
Illinois and Des Plaines rivers, Ill.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- WISTON BROTHERS, *Contractors*.
Mississippi River, St. Paul to Des
Moines Rapids.
- WOLBRECHT, J. M., *Assistant Engineer*.
Archer's Hope River, Va.
Cataba River, N. C.
Pamunkey River, Va.
Santee River and Canal, S. C.
Wateree River, S. C.
York River, Va.
- WOOD, H. B., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- WOOD, W. H., *Assistant Engineer*.
Missouri River, between Sioux City and
Fort Bentou.
Raritan River, N. J.
Shrewsbury River, N. J.
- WOODS. (See HINGSTON & WOODS.)
- WOOTON & BRONDAWAY, *Contractors*.
Tensas River and Bayou Macon.
- WORDEN, J. R., *Contractor*.
Au Sable River and Harbor, Mich.
- WORRELL, J., *Assistant Engineer*.
Clarion River, Pa.
Red Bank Creek, Pa.
Susquehanna River, Pa.
- WORTHEN, J. A., *Assistant Engineer*.
Mississippi River, between mouths of
Illinois and Ohio rivers.
- WORTHINGTON, G., & Co., *Contractors*.
Cleveland Harbor, Ohio.
- WRIGHT. (See MEACHAM & WRIGHT.)
- WRIGHT. (See MOORE & WRIGHT.)
- WRIGHT, A. R., *Contractor*.
Lynn Harbor, Mass.
Royal River, Me.
- WRIGHT, J. G., *Assistant Engineer*.
Brazos Santiago Harbor, Tex.
- WRIGHT, W. W., *Contractor*.
Cathance River, Mo.
- YEAGER, F. A., *Assistant Engineer*.
Mississippi River, between mouth of
Ohio River and Head of Passes.
- YEATES, C. M., *Assistant Engineer*.
Beaufort Harbor, N. C.
Meherrin River, N. C.
Winyaw Bay, S. C.
- YONGE, S. K., *Assistant Engineer*.
Missouri River, from mouth to Sioux
City.
- YUILLE, G. B., *Assistant Engineer*.
Tallapoosa River, Ala.

SUMMARY OF APPROPRIATIONS for Rivers and Harbors

from the earliest date, April 6, 1802, to and including the act of August 11, 1888, except as subsequently noted.

PLAN.—The States are arranged in alphabetical order, and under each State are placed the appropriations for the works lying wholly within that State, these works being also arranged alphabetically. All the appropriations for the improvement of any portion of a river, except a harbor, are assigned to that river, and if the river passes through or by more than one State the river is placed under the head of "Miscellaneous," which immediately follows the States. Thus, appropriations for the Muscle Shoals would not be found under Alabama, but would be included in those for the Tennessee River, which would be found under "Miscellaneous;" appropriations for an ice harbor at St. Louis would be under the State of Missouri, but appropriations for the Mississippi River at St. Louis, or for the mouth of the Mississippi River, would be included in those for the Mississippi River. Explanatory notes are placed at the end of the table, which are referred to by numerals in parenthesis.

The same locality is sometimes referred to in the acts making appropriations therefor under different titles, or a local improvement has become merged in one more general. For such cases the most usual or comprehensive title has been adopted in this table.

[**NOTE.**—The details of the appropriations and references to authorities for each sum will be generally found under the proper title of the work in Vols. I and II of the Index.

The lists of appropriations in the main Index were generally compiled from the reports of the Chief of Engineers, beginning with 1866. The following table was compiled directly from the acts of Congress making appropriations for rivers and harbors, and subsequent to the completion of the main part of Vol. II of the Index, consequently in a few cases appropriations appear in this table which are not found in the lists of appropriations in the main work. These exceptions mainly apply to improvements completed before 1866, and for which no appropriations were subsequently made. In the earlier reports of the Chief of Engineers allotments from appropriations for "repair, preservation, contingencies, and surveys," are sometimes referred to as though they were specific appropriations for the works to which they were assigned. In the following table such allotments, except as subsequently noted, are not included in the aggregate of separate works. For these reasons, in a few cases, the total amount appropriated, as stated in the main Index, will be found to differ for the same work from the total stated in this table.

By the acts of June 28, 1864, July 25, 1868, and April 10, 1869, \$250,000, \$1,500,000, and \$2,000,000, were, respectively, appropriated for repair and extension, and allotted to works specified in the statements attached to these acts in the compilation of "Laws of the United States relating to the improvement of rivers and harbors." The amounts therein allotted are assigned in the following table to the works named. (See note 24.)

Between 1826 and 1874, inclusive, the sum of \$181,606.27 was re-appropriated; these re-appropriations are not included in the following table. The following appropriations have also been omitted: Transportation, fuel, etc., acts of August 30, 1852, and May 15, 1856 (aggregating \$12,127.12); allotments from indefinite appropriations for "removal of wrecks, etc.," as provided for by act of June 14, 1880.] (See note 25.)

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<i>Alabama:</i>					
Alabama River.....	1878	\$165,000.00	\$165,000.00
Black Warrior River (?).....	1884	224,250.00	224,250.00
Cahaba River.....	1882	37,500.00	37,500.00
Mobile Harbor.....	1826	1,629,880.60	1,629,880.60
Pase Au Heron.....	1828	18,000.00	18,000.00
Tallapoosa River.....	1882	40,000.00	40,000.00	\$2,114,580.60
<i>Arkansas:</i>					
Cache River.....	1888	7,000.00	7,000.00
Fourche La Pave River.....	1879	26,000.00	26,000.00
L'Anguille River.....	1878	17,000.00	17,000.00
Little Missouri River.....	1871	20,000.00	20,000.00
Little Red River.....	1886	8,400.00	8,400.00
Petit Jean River.....	1886	6,000.00	6,000.00
Saline River.....	1880	21,500.00	21,500.00
White River.....	1874	191,000.00	191,000.00
White and St. Francis Rivers (?).....	1883	144,000.00	\$1,500	145,500.00
White, Black, and Little Red (?).....	1871	10,000.00	10,000.00	452,400.00
<i>California:</i>					
Feather River. (See Sacramento and Feather Rivers.)					
Humbolt Bay and River.....	1881	342,500.00	342,500.00
Mokelumne River.....	1884	13,000.00	13,000.00

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
California—Continued.					
Napa River.....	1886	\$7,500.00		\$7,500.00	
Oakland Harbor.....	1874	1,284,400.00		1,284,400.00	
Petaluma Creek.....	1880	32,000.00		32,000.00	
Red Wood Harbor.....	1884	15,400.00		15,400.00	
Sacramento and Feather Rivers.....	1875	465,000.00		465,000.00	
San Diego Harbor.....	1852	112,000.00	\$5,000	117,000.00	
San Francisco Harbor and Bay (?).....	1868	165,927.27		165,927.27	
San Joaquin River.....	1876	183,750.00		183,750.00	
San Luis Obispo.....	1888	25,000.00		25,000.00	
Wilmington Harbor.....	1871	870,000.00		870,000.00	\$3,521,677.27
Connecticut:					
Black Rock Harbor.....	1836	56,550.00		56,550.00	
Bridgeport Harbor.....	1836	240,000.00		240,000.00	
Cedar Point Beach.....	1836	1,000.00		1,000.00	
Clinton Harbor.....	1882	3,000.00		3,000.00	
Connecticut River (?).....	1829	494,721.57	130	494,851.57	
Five Mile River Harbor.....	1888	5,000.00		5,000.00	
Housatonic River.....	1871	108,500.00		108,500.00	
Milford Harbor.....	1874	43,000.00		43,000.00	
Mill River.....	1829	10,587.43		10,587.43	
New Haven Harbor Breakwater.....	1879	370,000.00		370,000.00	
New Haven Harbor.....	1854	276,000.00		276,000.00	
New London Harbor.....	1881	17,300.00		17,300.00	
Norwalk Harbor.....	1829	104,000.00	80	104,080.00	
Saybrook Bar. (See Connecticut River.)					
Southport Harbor.....	1886	21,000.00		21,000.00	
Stamford Harbor.....	1829	15,000.00	100	15,100.00	
Stonington Harbor.....	1837	302,253.83	200	302,453.83	
Thames River.....	1829	356,500.00	800	356,800.00	
Westport (Saugatuck) Harbor.....	1826	18,416.00		18,416.00	2,442,638.83
Delaware:					
Broad Creek.....	1880	25,000.00		25,000.00	
Broad Kill River.....	1873	35,000.00		35,000.00	
Chincoteague and Delaware Bays.....	1886	68,750.00		68,750.00	
Christiana River. (See Wilmington Harbor.)					
Delaware Breakwater.....	1822	2,547,353.70	1,000	2,548,353.70	
Delaware Breakwater Harbor, removal of wrecks from.....	1880	25,000.00		25,000.00	
Delaware Bay, Ice Harbor.....	1882	25,000.00		25,000.00	
Delaware River, Ice Harbor at Reedy Island.....	1852	51,090.00		51,090.00	
Duck Creek.....	1880	20,000.00		20,000.00	
Indian River.....	1882	10,000.00		10,000.00	
Lewes, Pier at.....	1870	368,500.00		368,500.00	
Mispillion Creek.....	1879	17,000.00		17,000.00	
Nantlooko River.....	1886	10,000.00		10,000.00	
New Castle Harbor.....	1826	231,073.00		231,073.00	
St. Jones' River.....	1881	40,000.00		40,000.00	
Wilmington Harbor.....	1836	289,606.00		289,606.00	3,764,372.70
District of Columbia:					
Washington and Georgetown Harbors (?).....	1883	2,015,000.00	1,500	2,016,500.00	2,016,500.00
Florida:					
Appalachicola Bay and River.....	1828	161,850.29	500	161,850.29	
Caloosahatchee River.....	1882	24,000.00		24,000.00	
Cedar Keys Harbor.....	1872	102,000.00		102,000.00	
Charlotte Harbor. (See Peas Creek.)					
Chipola River.....	1835	9,000.00		9,000.00	
Clearwater Harbor. (See Cedar Keys.)					
Indian River and Mosquito Lagoon.....	1844	6,500.00		6,500.00	
Key West Harbor.....	1882	52,500.00		52,500.00	
Lagrange Bayou.....	1886	5,000.00		5,000.00	
Manatee River.....	1882	30,000.00		30,000.00	
Ochlawaha River.....	1835	10,000.00		10,000.00	
Ochlochoonee River.....	1833	5,000.00		5,000.00	
Peas Creek.....	1881	16,000.00		16,000.00	
Pensacola Harbor.....	1878	250,000.00		250,000.00	
St. Augustine Harbor.....	1829	68,569.80	800	68,569.80	
St. John's River (?).....	1852	944,000.00		944,000.00	
St. John's River (Upper).....	1884	4,000.00		4,000.00	
St. Mark's River.....	1828	37,030.00	500	37,530.00	
Suwanee River.....	1839	53,000.00		53,000.00	

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
Florida—Continued.					
Tampa Bay.....	1880	\$95,000.00		\$95,000.00
Volusia Bar.....	1880	25,500.00		25,500.00
Withlacoochee River.....	1881	18,500.00		18,500.00
Yellow River.....	1889		\$500	500.00	\$1,918,450.00
Georgia:					
Altamaha River.....	1881	65,000.00		65,000.00
Brunswick Harbor.....	1886	137,500.00		137,500.00
Coosawattee River. (See Oostensaula River.)					
Darien Harbor.....	1878	8,000.00		8,000.00
Etowah River.....	1876	10,000.00		10,000.00
Filint River (?).....	1878	137,000.00		137,000.00
Jekyl Creek.....	1888	5,000.00		5,000.00
Ocmulgee River (?).....	1876	79,500.00		79,500.00
Oconee River.....	1878	45,000.00		45,000.00
Oostensaula and Coosawattee Rivers.	1874	26,000.00		26,000.00
Romerly Marsh.....	1882	42,108.77		42,108.77
St. Augustine Creek.....	1879	5,000.00		5,000.00
Savannah River and Harbor (?).....	1886	1,974,606.64	10,000	1,984,606.64	2,544,715.41
Idaho:					
Clearwater River.....	1879	15,000.00		15,000.00	15,000.00
Illinois:					
Calumet Harbor.....	1870	412,400.00		412,400.00
Chicago Harbor.....	1883	2,004,005.00		2,004,005.00
Galena River and Harbor.....	1878	66,000.00		66,000.00
Hennepin and Illinois and Michigan Canals.	1882		45,000	45,000.00
Illinois River.....	1862	1,566,650.00		1,566,650.00
Waukegan Harbor.....	1862	130,000.00		130,000.00	4,224,055.00
Indiana:					
Michigan City Harbor.....	1886	1,058,638.92		1,058,638.92
White River.....	1879	107,500.00		107,500.00	1,166,138.92
Iowa:					
Des Moines and Iowa Rivers.....	1888		1,000	1,000.00
Dubuque Harbor.....	1844	69,500.00		69,500.00
Red Cedar River.....	1839		1,500	1,500.00	72,000.00
Kentucky:					
Barren River. (See Green River.)					
Cumberland River (South Fork).....	1882	12,000.00		12,000.00
Green River and tributaries.....	1888	135,900.00		135,900.00
Kentucky River (?).....	1879	1,321,495.74		1,321,495.74
Licking River.....	1888	3,000.00		3,000.00
Muddy River. (See Green River.)					
Tradewater River.....	1881	16,500.00		16,500.00	1,487,995.74
Louisiana:					
Amite River.....	1880	20,000.00		20,000.00
Bayou Black.....	1881	25,000.00		25,000.00
Bayou Boeuf.....	1881	26,000.00		26,000.00
Bayou Courtableau.....	1880	29,000.00		29,000.00
Bayou D'Arbonne.....	1884	9,000.00		9,000.00
Bayou La Fourche.....	1862	80,000.00	2,500	82,500.00
Bayou Loggy.....	1884	10,000.00		10,000.00
Bayou Macon. (See Tensas River, La.)					
Bayou Pierre.....	1884	5,000.00	8,600	13,600.00
Bayou Plaquemine.....	1888	100,000.00		100,000.00
Bayous Roundaway and Vidal.....	1888	1,000.00		1,000.00
Bayou Teche.....	1829	50,000.00	700	50,700.00
Bayou Teche, Canal from.....	1881	25,000.00		25,000.00
Bayou Terrebonne.....	1880	38,800.00		38,800.00
Bayou Vidal. (See Bayou Roundaway.)					
Calcasieu Pass and River.....	1872	56,500.00		56,500.00
Cane River.....	1884	2,500.00		2,500.00
Lake Ponchartrain Canal.....	1809		25,000	25,000.00
Lake Ponchartrain Harbor.....	1862	25,000.00		25,000.00
Little River.....	1886	2,500.00		2,500.00
Tangipahoe River.....	1872	11,500.00		11,500.00
Tchefuncte River.....	1872	11,500.00		11,500.00
Tensas River and Bayou Macon.....	1881	16,000.00		16,000.00
Tickfaw River.....	1881	7,000.00		7,000.00
Tones Bayou. (See Red River, Ark., L., and Tex.)					
Vermillion River.....	1880	9,900.00		9,900.00	598,000.00

APPROPRIATIONS for Rivers, and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
Maine:					
Bangor Harbor and Penobscot River.....	1829	\$283,000.00	\$300	\$283,300.00	
Bar Harbor.....	1888	50,000.00		50,000.00	
Bath and Kennebec River.....	1827	281,945.71		281,945.71	
Bayaduce River.....	1888	3,000.00		3,000.00	
Belfast Bay and Harbor.....	1826	31,266.00		31,266.00	
Camden Harbor.....	1873	35,000.00		35,000.00	
Cathance River.....	1880	21,000.00		21,000.00	
Cobcook Bay.....	1836	5,000.00	300	5,300.00	
Jonesport. (See Moosabec River.)					
Kennebec River. (See Bath.)					
Kennebunk River.....	1829	65,175.00		65,175.00	
Lubec Channel.....	1880	125,000.00		125,000.00	
Machias River.....	1873	32,000.00		32,000.00	
Matineus Island, Breakwater.....	1852		1,000	1,000.00	
Moosabec River and Bar.....	1881	55,000.00		55,000.00	
Narraguagus River.....	1871	42,000.00		42,000.00	
Owl's Head Harbor.....	1836	17,592.11	400	17,992.11	
Piscataqua River.....	1826	8,310.00	200	8,510.00	
Portland Harbor.....	1836	557,727.05		557,727.05	
Penobscot River. (See Bangor Harbor.)					
Richmond Harbor.....	1881	20,000.00		20,000.00	
Richmond Island.....	1852	120,000.00		120,000.00	
Rockland Harbor.....	1880	152,500.00		152,500.00	
Rockport Harbor.....	1888	10,000.00		10,000.00	
Royal River.....	1871	30,000.00		30,000.00	
Saco River and Harbor.....	1827	241,775.00		241,775.00	
St. Croix River.....	1867	39,000.00		39,000.00	
Sullivan River.....	1871	35,000.00		35,000.00	
Union River.....	1870	30,000.00		30,000.00	
Wells' Harbor.....	1872	5,000.00		5,000.00	
York Harbor.....	1886	25,000.00		25,000.00	\$2,323,400.87
Maryland:					
Annapolis Harbor.....	1880	10,000.00		10,000.00	
Baltimore Harbor and Patapsco River.....	1836	2,571,830.00		2,571,830.00	
Battery Island, Chesapeake Bay.....	1886	17,275.00		17,275.00	
Breton Bay. (See Leonardtown Harbor.)					
Cambridge Harbor.....	1871	37,500.00		37,500.00	
Chesapeake Bay.....	1836		500	500.00	
Chester River.....	1876	41,000.00		41,000.00	
Choptank River.....	1880	37,500.00		37,500.00	
Corsica Creek.....	1882	30,000.00		30,000.00	
Crisfield Harbor.....	1875	37,317.50		37,317.50	
Deal's Island.....	1881	10,000.00		10,000.00	
Elk River.....	1874	31,500.00		31,500.00	
Fairlee Creek.....	1888	5,000.00		5,000.00	
Kent Island Narrows. (See Chester River.)					
Leonardtown Harbor (Breton Bay).....	1878	32,500.00		32,500.00	
Northeast River.....	1872	15,500.00		15,500.00	
Patapsco River. (See Baltimore Harbor.)					
Patuxent River.....	1888	5,000.00		5,000.00	
Pocomoke River.....	1878	20,500.00		20,500.00	
Queenstown Harbor.....	1871	14,000.00		14,000.00	
St. Jerome's Creek.....	1881	26,500.00		26,500.00	
Secretary Creek.....	1880	6,000.00		6,000.00	
Susquehanna River.....	1852	158,390.00		158,390.00	
Treadhaven Creek.....	1880	6,000.00		6,000.00	
Wicomico River.....	1872	50,000.00		50,000.00	
Worton Harbor.....	1872	12,000.00		12,000.00	3,175,812.50
Massachusetts:					
Ass River.....	1829	20,000.41	150	20,150.41	
Boston Harbor.....	1825	2,309,196.10		2,309,196.10	
Duxbury Harbor.....	1836	25,000.00		25,000.00	
East Dennis Breakwater.....	1852		1,500	1,500.00	
Edgartown Harbor.....	1826	22,500.00	500	23,000.00	
Fall River Harbor.....	1874	30,000.00		30,000.00	
Gloucester Harbor.....	1823	31,000.00		31,000.00	
Hingham Harbor.....	1886	11,000.00		11,000.00	
Hyannis Harbor.....	1827	143,431.82		143,431.82	
Ipswich River.....	1886	5,000.00		5,000.00	

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
Massachusetts—Continued.					
Lynn Harbor.....	1882	\$76,000.00		\$76,000.00	
Malden River.....	1882	10,000.00		10,000.00	
Manchester Harbor.....	1888	2,500.00		2,500.00	
Marblehead Harbor.....	1825	500.00	\$400	900.00	
Merrimac River.....	1828	230,866.72		230,866.72	
Nantucket Harbor.....	1828	190,834.75	300	190,834.75	
New Bedford Harbor.....	1836	47,691.37		47,691.37	
Newburyport Harbor.....	1880	232,500.00		232,500.00	
Plymouth Harbor.....	1824	178,066.90		178,066.90	
Powow River.....	1888	3,000.00		3,000.00	
Provincetown Harbor.....	1826	179,328.44		179,328.44	
Rockport. (See Sandy Bay.)					
Salem River.....	1873	25,000.00		25,000.00	
Sandy Bay Harbor of Refuge.....	1829	369,232.57		369,232.57	
Seitate Harbor.....	1829	52,500.00	1,180	53,680.00	
Taunton River.....	1852	157,000.00	3,000	160,000.00	
Vineyard Haven Harbor.....	1888	25,000.00		25,000.00	
Wareham Harbor.....	1872	84,000.00		84,000.00	
Wellfleet Harbor.....	1872	12,000.00		12,000.00	
Westport Harbor.....	1886	1,000.00		1,000.00	
Winthrop Harbor.....	1888	1,000.00		1,000.00	
Wood's Holl Harbor.....	1852	109,000.00		109,000.00	\$4,590,879.08
Michigan:					
Alpena Harbor.....	1876	19,500.00		19,500.00	
Au Sable River and Harbor.....	1867	113,970.00		113,970.00	
Aux Bees Seles. (See Frankfort Harbor.)					
Belle River.....	1881	14,000.00		14,000.00	
Benton Harbor. (See St. Joseph's River.)					
Black Lake Harbor.....	1852	264,615.31		264,615.31	
Black River.....	1888	10,000.00		10,000.00	
Cedar River.....	1882	30,000.00		30,000.00	
Charlevoix Harbor.....	1876	93,500.00		93,500.00	
Cheboygan Harbor.....	1871	148,000.00		148,000.00	
Clinton River.....	1852	41,500.00		41,500.00	
Detroit River.....	1874	708,000.00		708,000.00	
Eagle Harbor.....	1867	97,000.00		97,000.00	
Frankfort Harbor.....	1866	263,659.85		263,659.85	
Grand Marais Harbor.....	1880	181,250.00		181,250.00	
Grand River.....	1881	50,000.00		50,000.00	
Grand River and Harbor.....	1825	548,866.15		548,866.15	
Harbor of Refuge, Lake Huron. (See Sand Beach, Mich.)					
La Plaisance Bay.....	1826	19,803.07	200	19,803.07	
Ludington Harbor.....	1867	352,435.00		352,435.00	
Manistee Harbor.....	1867	248,000.00		248,000.00	
Manistique Harbor.....	1880	6,000.00		6,000.00	
Marquette Harbor.....	1867	354,230.00		354,230.00	
Monroe Harbor.....	1835	220,515.27		220,515.27	
Muskegon Harbor.....	1867	279,000.00		279,000.00	
New Buffalo Harbor.....	1852	83,000.00		83,000.00	
Ontonagon Harbor.....	1867	298,100.00		298,100.00	
Pontwater Harbor.....	1867	228,820.00		228,820.00	
Portage Lake Ship Canal.....	1886		10,000	10,000.00	
Portage Lake Harbor.....	1879	92,500.00		92,500.00	
Rouge River.....	1888	10,000.00		10,000.00	
Saginaw River.....	1866	493,750.00		493,750.00	
St. Clair River Flats and Canal ⁽⁹⁾	1852	783,894.40		783,894.40	
St. Joseph's Harbor.....	1836	347,113.00		347,113.00	
St. Joseph's River.....	1888	2,500.00		2,500.00	
St. Mary's River and Falls Canal ⁽¹⁰⁾	1856	5,067,900.22		5,067,900.22	
Sand Beach, Lake Huron.....	1871	1,130,000.00		1,130,000.00	
Saugtuck Harbor.....	1868	140,439.00		140,439.00	
Sebewaing Harbor.....	1875	15,000.00		15,000.00	
South Haven Harbor.....	1867	192,000.00		192,000.00	
White River Harbor.....	1867	257,550.00		257,550.00	13,178,411.27
Minnesota:					
Agate Bay.....	1886	37,500.00		37,500.00	
Burlington Bay. (See Agate Bay.)					
Duluth Harbor.....	1871	516,250.00		516,250.00	
Grand Marais Harbor.....	1879	95,000.00		95,000.00	
Lake City. (See Miscellaneous, Lake Pepin.)					
Minnesota River.....	1867	127,500.00		127,500.00	776,250.00

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
Mississippi:					
Big Black River.....	1884	\$10,000.00		\$10,000.00	
Big Sunflower River.....	1879	52,000.00		52,000.00	
Biloxi Harbor and Bay.....	1882	36,000.00		36,000.00	
Coldwater River.....	1879	11,000.00		11,000.00	
East Pascagoula River.....	1882		\$5,000	5,000.00	
Horn Island Pass.....	1884	5,000.00		5,000.00	
Noxubee River.....	1880	50,000.00		50,000.00	
Old Town Creek.....	1882	3,000.00		3,000.00	
Pascagoula River.....	1827	131,500.00		131,500.00	
Pearl River.....	1879	141,125.00		141,125.00	
Steel's Bayou.....	1884	7,500.00		7,500.00	
Tallahatchee River.....	1879	32,500.00		32,500.00	
Tohula Lake.....	1881	12,000.00		12,000.00	
Yallahusha River.....	1881	11,000.00		11,000.00	
Yazoo River.....	1873	190,000.00		190,000.00	\$697,625.00
Missouri:					
Culvre River.....	1880	12,000.00		12,000.00	
Gasconade River.....	1880	42,500.00		42,500.00	
Little River.....	1888	5,000.00		5,000.00	
St. Louis Ice Harbor.....	1886	164,600.00		164,600.00	224,100.00
New Hampshire:					
Bellamy River.....	1888	10,000.00		10,000.00	
Cocheco River.....	1836	170,000.00		170,000.00	
Exeter River.....	1880	35,000.00		35,000.00	
Lake Winnipiseogee.....	1880	7,500.00		7,500.00	
Lamprey River.....	1886	20,000.00		20,000.00	
Little Harbor.....	1886	30,000.00		30,000.00	
Portsmouth Harbor.....	1879	124,000.00		124,000.00	396,500.00
New Jersey:					
Atlantic City Harbor.....	1886		5,000	5,000.00	
Cheesequakes Creek.....	1880	40,000.00		40,000.00	
Cohansey Creek.....	1873	36,000.00		36,000.00	
Cranberry Inlet.....	1882		1,000	1,000.00	
Elizabeth River.....	1879	27,000.00		27,000.00	
Flat Beach.....	1829		100	100.00	
Keyport Harbor.....	1882	30,475.00		30,475.00	
Little Egg Harbor.....	1886	23,500.00		23,500.00	
Manasquan River.....	1879	39,000.00		39,000.00	
Mantua Creek.....	1882	3,000.00		3,000.00	
Mattawan Creek.....	1881	21,000.00		21,000.00	
Maurice River.....	1882	35,000.00		35,000.00	
Newark Bay.....	1882	10,000.00	2,000	12,000.00	
Passaic River.....	1872	333,250.00		333,250.00	
Raccoon River.....	1882	3,000.00		3,000.00	
Rahway River.....	1879	37,000.00		37,000.00	
Rancocas River.....	1881	20,000.00		20,000.00	
Raritan Bay.....	1881	182,500.00		182,500.00	
Raritan River.....	1886	535,213.00		535,213.00	
Salem River.....	1871	14,500.00		14,500.00	
Shrewsbury River.....	1882	213,000.00	1,500	214,500.00	
South River.....	1871	66,000.00		66,000.00	
Woodbridge Creek.....	1879	19,000.00		19,000.00	
Woodbury Creek.....	1882	5,000.00		5,000.00	1,723,038.00
New York:					
Black River.....	1886	42,401.00		42,401.00	
Black Rock Harbor.....	1829	52,098.00		52,098.00	
Buffalo Harbor.....	1826	2,152,995.37		2,152,995.37	
Buttermilk Channel.....	1880	346,250.00		346,250.00	
Canarsie Bay.....	1880	43,000.00		43,000.00	
Cattaraugus Creek.....	1886	57,410.00		57,410.00	
Charlotte Harbor.....	1828	444,028.40		444,328.40	
Dankirk Harbor.....	1827	491,579.38	300	491,879.38	
East Chester Creek.....	1873	69,000.00		69,000.00	
East River and Hell Gate.....	1852	3,930,700.00		3,930,700.00	
Echo Harbor.....	1878	22,000.00		22,000.00	
Flushing Bay.....	1879	85,000.00		85,000.00	
Glen Cove Harbor.....	1888	20,000.00		20,000.00	
Gowanus Bay.....	1881	132,500.00		132,500.00	
Grass River.....	1882	3,000.00		3,000.00	
Greenport Harbor.....	1882	30,000.00		30,000.00	
Harlem River.....	1874	480,000.00		480,000.00	
Hell Gate. (See East River.)					
Hudson River.....	1834	1,548,538.00		1,548,538.00	
Hudson River (opposite Jersey City).....	1875	25,000.00		25,000.00	

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<i>New York—Continued.</i>					
Huntington Harbor.....	1873	\$22,500.00		\$22,500.00	
Mamaroneck Harbor.....	1882	15,000.00		15,000.00	
New Rochelle Harbor.....	1881	35,000.00		35,000.00	
Newtown Creek and Bay.....	1880	107,500.00		107,500.00	
New York Harbor (Gedney's Channel).....	1884	1,330,000.00		1,330,000.00	
New York Harbor, Sandy Hook (11). Niagara River at Tonawanda Creek.....	1868	116,530.00		116,530.00	
Oak Orchard.....	1886	106,500.00		106,500.00	
Ogdensburg Harbor.....	1852	200,000.00		200,000.00	
Olcott Harbor.....	1867	137,005.56	\$3,000	160,005.56	
Oswego Harbor.....	1867	133,000.00		133,000.00	
Peconic River.....	1836	1,729,412.87	600	1,730,012.87	
Plattsburgh Harbor.....	1871	25,000.00		25,000.00	
Port Chester Harbor.....	1836	153,180.01		153,180.01	
Port Jefferson Harbor.....	1872	32,000.00		32,000.00	
Portland Harbor.....	1862	79,000.00	1,200	80,200.00	
Port Ontario Harbor.....	1836	56,616.00		56,616.00	
Pultneyville Harbor.....	1836	50,000.00		50,000.00	
Rondout Harbor.....	1870	71,000.00		71,000.00	
Rouses' Point Harbor.....	1872	100,500.00		100,500.00	
Sackett's Harbor.....	1884	68,500.00		68,500.00	
Sag Harbor.....	1826	15,000.00		15,000.00	
Sandy Creek.....	1829		150	150.00	
Saugerties Harbor.....	1828		300	300.00	
Sheepshead Bay.....	1884	32,000.00		32,000.00	
Sodus Harbor (Great).....	1880	26,000.00		26,000.00	
Sodus Harbor (Little).....	1829	427,646.80		427,646.80	
Staten Island Ice Breaker.....	1852	297,941.77		297,941.77	
Sumpwauus Inlet.....	1836	19,500.00		19,500.00	
Ticonderoga River.....	1881	7,000.00		7,000.00	
Tonawanda Creek. (See Niagara River.)	1881	14,500.00		14,500.00	
Waddington Harbor.....	1873	35,500.00		35,500.00	
Whitehall Harbor.....	1886	33,000.00		33,000.00	
Wilson Harbor.....	1875	65,000.00		65,000.00	\$15,542,383.16
<i>North Carolina:</i>					
Beaufort Harbor.....	1836	135,000.00		135,000.00	
Beaufort Harbor and New River, water-way between.....	1837	60,000.00		60,000.00	
Black River.....	1886	3,000.00		3,000.00	
Cape Fear River.....	1829	2,556,478.92		2,556,478.92	
Cape Fear and Waccamaw Rivers.....	1888	15,000.00		15,000.00	
Coanok Bay. (See Currituck Sound.)					
Contentnea Creek.....	1881	45,000.00		45,000.00	
Croatan Sound.....	1843	50,000.00	15,000	65,000.00	
Currituck Sound and North River Bar.....	1878	142,500.00		142,500.00	
Edenton Bay.....	1878	17,000.00		17,000.00	
Lillington River.....	1881	6,000.00		6,000.00	
Lumber River.....	1888	5,000.00		5,000.00	
Meherrin River.....	1882	5,000.00		5,000.00	
Neuse River.....	1878	252,500.00		252,500.00	
New Berne to Beaufort.....	1886	25,000.00		25,000.00	
Newport River. (See New Berne to Beaufort.)					
New River.....	1836	28,000.00		28,000.00	
North River Bar. (See Currituck Sound.)					
Ocracoke Inlet.....	1826	132,750.00	1,000	133,750.00	
Pamlico and Tar Rivers.....	1886	78,000.00		78,000.00	
Pasquotank River.....	1829		80	80.00	
Perquimans River.....	1876	2,500.00		2,500.00	
Roanoke River.....	1871	113,000.00		113,000.00	
Scuppernon River.....	1878	8,000.00		8,000.00	
Tar River. (See Pamlico and Tar Rivers.)					
Town Creek.....	1881	1,000.00		1,000.00	
Trent River.....	1879	50,500.00		50,500.00	
Washington Harbor.....	1862	5,000.00		5,000.00	
Wilmington. (See Cape Fear River.)					
Yadkin River.....	1879	97,000.00		97,000.00	3,849,306.92

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
Ohio:					
Ashtabula Harbor	1886	\$428,168.28		\$428,168.28	
Black River Harbor	1828	220,204.77		220,204.77	
Cincinnati Ice Harbor	1878	94,250.00		94,250.00	
Cleveland Harbor	1825	1,447,994.84		1,447,994.84	
Conneaut Harbor	1829	112,629.39		112,629.39	
Cuyahoga Creek	1826	19,781.12		19,781.12	
Fairport Harbor	1825	290,873.53		290,873.53	
Grand River Harbor. (See Fair- port Harbor.)					
Huron Harbor	1826	123,273.71		123,273.71	
Maumee River	1872	7,000.00		7,000.00	
Muskingum River Locks and Dams	1886	122,000.00		122,000.00	
Muskingum River Ice Harbor	1879	297,500.00		297,500.00	
Port Clinton Harbor	1872	63,000.00		63,000.00	
Rocky River	1872	39,040.00		39,000.00	
Sandusky City Harbor	1826	320,080.00	\$400	320,480.00	
Sandusky River	1867	51,500.00		51,500.00	
Toledo Harbor	1866	997,200.00		997,200.00	
Vermilion Harbor	1826	124,701.28		124,701.28	\$4,759,554.86
Oregon:					
Columbia, at mouth	1878	785,000.00	10,000	805,000.00	
Columbia and Snake Rivers	1876	131,000.00		131,000.00	
Columbia River Cascades	1876	1,442,500.00		1,442,500.00	
Columbia River (Upper)	1872	105,000.00		105,000.00	
Columbia and Willamette	1876	785,385.00	5,000	785,385.00	
Coos Bay	1879	213,750.00		213,750.00	
Coquille River	1880	75,000.00		75,000.00	
Snake River. (See Columbia River, Upper.)					
Tillamook Bay	1888	5,200.00		5,200.00	
Umpqua River	1871	24,501.47		24,501.47	
Willamette River (Upper)	1871	184,500.00		184,500.00	
Yamhill River. (See Willamette River, Upper.)					
Yaquina Bay	1880	385,000.00		385,000.00	4,154,516.47
Pennsylvania:					
Allegheny River	1879	232,500.00		232,500.00	
Chester Creek	1881	6,000.00		6,000.00	
Chester Harbor	1826	32,383.40	100	32,483.40	
Erie Harbor	1823	851,717.23	150	851,867.23	
Frankford Creek	1882	10,000.00		10,000.00	
Marcus Hook	1829	214,000.00		214,000.00	
Ridley Creek. (See Chester Creek.)					
Schuylkill River	1870	393,750.00		393,750.00	
Susquehanna River	1880	45,000.00		45,000.00	1,785,600.63
Rhode Island:					
Block Island	1870	360,000.00		360,000.00	
Church Cove Harbor	1827	28,000.00	200	28,200.00	
Newport Harbor	1873	120,500.00		120,500.00	
Pawtucket River	1887	167,000.00		167,000.00	
Potowomut River	1881	5,000.00		5,000.00	
Providence River and Narragan- sett Bay	1852	628,250.00		628,250.00	
Warren River	1886	5,000.00		5,000.00	
Wickford Harbor	1873	10,000.00		10,000.00	1,322,960.00
South Carolina:					
Ashepoo River	1872	1,300.00		1,300.00	
Ashley River	1880	5,500.00		5,500.00	
Charleston Harbor	1852	1,982,200.00		1,982,200.00	
Clark's Creek	1888	2,500.00		2,500.00	
Congaree River	1886	15,000.00		15,000.00	
Edisto River	1862	21,000.00		21,000.00	
Georgetown Harbor	1836	24,500.00	4,000	28,500.00	
Mingo Creek	1888	5,000.00		5,000.00	
Pee Dee River (Great)	1880	67,000.00		67,000.00	
Pee Dee River (Little)	1888	5,000.00		5,000.00	
Salkehatchie River	1882	13,000.00		13,000.00	
Santee River	1881	99,750.00		99,750.00	
Sullivan's Island. (See Charleston Harbor.)					
Town Creek	1870	7,500.00		7,500.00	
Wappoo Cut	1881	33,000.00		33,000.00	
Wateree River	1881	47,500.00		47,500.00	
Winyaw Bay	1886	118,750.00		118,750.00	2,452,500.00

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<i>Tennessee:</i>					
Big Hatchie River.....	1880	\$27,000.00		\$27,000.00	
Caney Fork River.....	1880	22,500.00		22,500.00	
Clinch River.....	1880	31,000.00		31,000.00	
Deer River (North and South Forks).....	1882	19,500.00		19,500.00	
Duck River.....	1880	13,000.00		13,000.00	
Hiwassee River.....	1875	35,000.00		35,000.00	
Little Tennessee River.....	1882	5,000.00		5,000.00	
Obeys River.....	1880	11,500.00		11,500.00	
Red River.....	1881	5,000.00		5,000.00	\$169,500.00
<i>Texas:</i>					
Aransas Pass and Bay.....	1879	581,250.00		581,250.00	
Blue Buck Bar. (See Sabine Pass.)					
Brazos River.....	1880	158,750.00		158,750.00	
Brazos Santiago Harbor.....	1879	253,500.00		253,500.00	
Buffalo Bayou.....	1881	143,750.00		143,750.00	
Colorado River.....	1882	20,000.00		20,000.00	
Corpus Christi. (See Aransas Pass.)					
Fort Brown. (See Rio Grande River.)					
Galveston Bay.....	1872	576,700.00	\$10,000	586,700.00	
Galveston Harbor.....	1870	2,278,000.00		2,278,000.00	
Indianola Harbor. (See Matagorda Bay.)					
Matagorda Bay.....	1876	327,500.00		327,500.00	
Neches River.....	1878	33,000.00		33,000.00	
Paso Cavallo. (See Matagorda Bay.)					
Red Fish Bar. (See Galveston Bay.)					
Rio Grande at Fort Brown.....	1876	18,000.00		18,000.00	
Sabine Pass.....	1882	1,111,750.00	5,000	1,116,750.00	
Sabine River.....	1872	32,000.00	2,700	34,700.00	
San Antonio River.....	1882		1,500	1,500.00	
Trinity River.....	1882	47,000.00	3,000	50,000.00	5,608,400.00
<i>Vermont:</i>					
Burlington Harbor.....	1836	561,922.20		561,922.20	
Gordon's Landing.....	1886	28,750.00		28,750.00	
Hero Island Channel.....	1836	31,000.00		31,000.00	
Otter Creek.....	1872	36,500.00		36,500.00	
Swanton Harbor.....	1873	70,500.00		70,500.00	728,672.20
<i>Virginia:</i>					
Accotink Creek.....	1872	5,000.00		5,000.00	
Appomattox River.....	1871	393,750.00		393,750.00	
Aquia Creek.....	1872	10,500.00		10,500.00	
Archer's Hope River.....	1881	10,000.00		10,000.00	
Black Water River.....	1878	14,000.00		14,000.00	
Chickahominy River.....	1878	21,500.00		21,500.00	
Elizabeth River.....	1829	40,000.00	80	40,080.00	
Hampton River.....	1878	12,000.00		12,000.00	
James River.....	1836	1,152,500.00	500	1,153,000.00	
James and Appomattox Rivers.....	1852	45,000.00		45,000.00	
Mattaponi River.....	1880	16,300.00		16,300.00	
Nansemond River.....	1873	47,000.00		47,000.00	
Neabsco Creek.....	1881	5,000.00		5,000.00	
Nomini Creek.....	1873	37,500.00		37,500.00	
Norfolk Harbor and approaches.....	1876	682,500.00		682,500.00	
Nottoway River.....	1880	7,000.00		7,000.00	
Ocoquan River.....	1873	25,000.00		25,000.00	
Onancock Harbor.....	1879	8,000.00		8,000.00	
Pagan Creek.....	1880	10,000.00		10,000.00	
Pamunkey River.....	1880	15,500.00		15,500.00	
Potomac River (at Mount Vernon).....	1879	14,500.00		14,500.00	
Rappahannock River.....	1852	202,500.00	3,000	205,500.00	
Staunton River.....	1879	44,500.00		44,500.00	
Totusky River.....	1880	10,000.00		10,000.00	
Urbana Creek.....	1879	15,500.00		15,500.00	
York River.....	1880	128,750.00		128,750.00	2,977,380.00
<i>Washington Territory:</i>					
Chehalis River.....	1882	10,000.00		10,000.00	
Cowlitz River.....	1880	11,000.00		11,000.00	
Skagit, Stielaquamish, Nootsack, and Snohomish Rivers.....	1880	57,500.00		57,500.00	78,500.00
<i>West Virginia:</i>					
Buckhannon River.....	1884	4,500.00		4,500.00	
Elk River.....	1878	21,500.00		21,500.00	
Gauley River.....	1888	3,000.00		3,000.00	

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States, Rivers, etc.
<i>West Virginia—Continued.</i>					
Great Kanawha River ⁽¹²⁾	1873	\$2,370,337.00		\$2,370,337.00	
Guyandotte River.....	1873	14,500.00		14,500.00	
Little Kanawha River.....	1876	171,175.00		171,175.00	\$2,585,012.00
<i>Wisconsin:</i>					
Ahnapee Harbor.....	1871	160,000.00		160,000.00	
Ashland Harbor.....	1886	82,500.00		82,500.00	
Chippewa River.....	1876	126,750.00		126,750.00	
Fox and Wisconsin Rivers ⁽¹³⁾	1839	3,125,831.07	\$2,000	3,127,831.07	
Green Bay Harbor.....	1866	287,550.00		287,550.00	
Kenosha Harbor.....	1844	227,807.41		227,807.41	
Kewaunee Harbor.....	1881	55,000.00		55,000.00	
Manitowoc Harbor.....	1852	299,830.00		299,830.00	
Milwaukee Bay.....	1881	415,000.00		415,000.00	
Milwaukee Harbor.....	1836	373,537.45	400	373,937.45	
Oconto Harbor.....	1881	68,000.00		68,000.00	
Pensaukee Harbor.....	1882	15,000.00		15,000.00	
Port Washington Harbor.....	1870	174,500.00		174,500.00	
Racine Harbor.....	1844	247,285.00		247,285.00	
Sheboygan Harbor.....	1852	303,448.91		303,448.91	
Stockholm. (See Miscellaneous, Lake Pepin.).....					
Sturgeon Bay Canal.....	1873	170,000.00		170,000.00	
Superior Bay and City and St. Louis Bay.....	1873	541,050.00		541,050.00	
Two Rivers Harbor.....	1871	200,500.00		200,500.00	6,876,023.84
Wisconsin River. (See Fox and Wisconsin Rivers.).....					
<i>Miscellaneous:</i>					
Arkansas River: Improvement (Ark. and Kans.).....	1878	442,500.00	19,000	461,500.00	
Arkansas River: Removal of snags. Arthur Kill (N. Y. and N. J.).....	1832	320,875.00		320,875.00	782,375.00
Bayou Bartholomew (Ark. and La.).....	1888	10,000.00		10,000.00	10,000.00
Big Sandy River (Ky. and W. Va.).....	1881	28,000.00		28,000.00	28,000.00
Black River (Ark. and Mo.).....	1878	265,500.00		265,500.00	265,500.00
Calumet River (Ill. and Ind.).....	1880	68,000.00		68,000.00	68,000.00
Chattahoochee River (Ala. and Ga.).....	1884	130,000.00		130,000.00	130,000.00
Chattahoochee and Flint Rivers (Ala. and Ga.).....	1835	175,000.00		175,000.00	175,000.00
Chesapeake and Delaware Bays Canal (Md. and Del.) ⁽¹⁴⁾	1874	70,000.00		70,000.00	70,000.00
Choctawhatchie River (Fla. and Ala.).....			10,000	10,000.00	10,000.00
Choctawhatchie and Holmes Rivers (Fla. and Ala.).....	1833	102,000.00		102,000.00	102,000.00
Colorado River (Cal., Nev., and Ariz.).....	1844	10,000.00		10,000.00	10,000.00
Conecuh River. (See Escambia River, Ala. and Fla.).....	1884	25,000.00		25,000.00	25,000.00
Coosa River (Ga. and Ala.).....	1876	523,700.00		523,700.00	523,700.00
Cumberland River (Ky. and Tenn.).....	1832	1,041,000.00		1,041,000.00	1,041,000.00
Cumberland Sound (Ga. and Fla.).....	1880	480,000.00		480,000.00	480,000.00
Current River (Mo. and Ark.).....	1872	7,000.00		7,000.00	7,000.00
Cypress Bayou (La. and Tex.).....	1872	117,000.00		117,000.00	117,000.00
Dan River (Va. and N. C.).....	1880	50,500.00		50,500.00	50,500.00
Delaware River (Pa., N. J., and Del.).....	1836	2,012,000.00		2,012,000.00	
Delaware River at Philadelphia.....	1886	500,000.00	5,000	505,000.00	
Delaware River, Public Piers.....	1802	34,961.71		34,961.71	2,551,961.71
Dismal Swamp Canal (Va. and N. C.) ⁽¹⁵⁾	1826	175,000.00	10,000	185,000.00	185,000.00
Escambia and Conecuh Rivers (Ala. and Fla.).....	1833	72,500.00		72,500.00	72,500.00
Falls of Ohio River. (See Ohio River.).....					
Falls of St. Anthony. (See Missis- sippi River.).....					
French Broad River (Tenn. and N. C.).....	1876	71,000.00		71,000.00	71,000.00
Harbor of Refuge, Pacific coast.....	1879	150,000.00		150,000.00	150,000.00
Lake Champlain, at Narrows (N. Y. and Vt.).....	1886	45,000.00		45,000.00	45,000.00
Lake Pepin Harbor of Refuge (Minn. and Wis.).....	1882	60,000.00		60,000.00	60,000.00

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by Rivers, etc.
<i>Miscellaneous—Continued.</i>					
Louisville and Portland Canal. (See Ohio River.)					
Menomonee Harbor (Wis. and Mich.)	1871	\$212,000.00		\$212,000.00	\$212,000.00
Mississippi River:					
Reservoirs at sources of.....	1879	649,500.00	\$25,000	674,500.00	
Above Falls of St. Anthony.....	1874	115,000.00		115,000.00	
At Falls of St. Anthony.....	1870	615,000.00		615,000.00	
At Meeker's Island.....	1873	25,000.00		25,000.00	
St. Paul to Des Moines Rapids (¹⁶) (¹⁷).....	1876	2,333,100.00		2,333,100.00	
At Des Moines Rapids (¹⁸).....	1856	5,323,450.00		5,323,450.00	
At Rock Island Rapids.....	1866	1,166,650.00		1,166,650.00	
Rock Island and Des Moines Rapids.....	1852	100,000.00		100,000.00	
From Des Moines Rapids to Ohio River (¹⁶).....	1852	5,436,000.00		5,436,000.00	
Removal of snags, etc., from Upper.....	1870	407,000.00		407,000.00	
Removal of snags, etc., from Lower.....	1868	436,250.00		436,250.00	
From Ohio River to the Passes (¹⁶).....	1874	13,010,000.00	25,000	13,035,000.00	
At its mouth (¹⁹).....	1836	7,875,169.53	261,492	8,136,661.53	
From Passes to headwaters.....	1834		180,000	180,000.00	
Water gauges on.....	1876		51,700	51,700.00	
Mississippi River Commission, expenses of.....	1879		850,000	850,000.00	88,885,311.53
Missouri River:					
From mouth to Sioux City (¹⁶).....	1876	3,551,500.00		3,551,500.00	
From Sioux City to Fort Ben- ton (¹⁶).....	1876	475,000.00	15,000	490,000.00	
From mouth to Fort Benton.....	1878		180,000	180,000.00	
Removal of snags, etc.....	1852	387,000.00		387,000.00	4,608,500.00
Monongahela River (Pa. and W. Va.) (²⁰).....	1872	619,033.13		619,033.13	619,033.13
Narragansett Bay, Little (R. I. and Conn.).....	1876	36,000.00		36,000.00	36,000.00
New River (Va. and W. Va.).....	1876	112,000.00		112,000.00	112,000.00
North Landing River (Va. and N. C.).....	1879	55,500.00		55,500.00	55,500.00
Ohio River (except the Falls) (²¹).....	1835	4,691,914.25		4,691,914.25	
Ohio River (at the Falls) (²²).....	1852	3,754,657.91	5,000	3,759,657.91	
Ohio River, removal of snags, etc.....	1827	30,000.00		30,000.00	8,481,572.16
Osage River (Mo. and Kans.).....	1871	205,000.00		205,000.00	205,000.00
Ouachita River (La. and Ark.).....	1871	336,500.00		336,500.00	336,500.00
Pawcatuck River (R. I. and Conn.).....	1871	72,000.00		72,000.00	72,000.00
Red River of the North (Minn. and Dak.).....	1876	193,000.00		193,000.00	193,000.00
Red River of the South (Ark., La., and Tex.).....	1828	1,625,137.50		1,625,137.50	1,625,137.50
Rock River (Ill. and Wis.).....	1838		1,000	1,000.00	1,000.00
St. Croix River (Minn. and Wis.).....	1878	92,500.00		92,500.00	92,500.00
St. Francis River (Ark. and Mo.).....	1871	44,000.00		44,000.00	44,000.00
St. John's and St. Mary's Rivers (Fla. and Ga.).....	1828	78,000.00		78,000.00	78,000.00
St. John's and St. Mary's Rivers Canals to Gulf of Mexico.....	1826		30,400	50,400.00	30,400.00
Savannah, Ockmulgee, Flint, and Chattahoochee Rivers (Ga.).....	1852		10,000	10,000.00	10,000.00
Shenandoah River (Va. and W. Va.).....	1880	17,500.00		17,500.00	17,500.00
Staten Island Channels (N. Y. and N. J.).....	1874	184,000.00		184,000.00	184,000.00
Tennessee River (Ky., Tenn., and Ala.).....	1827	3,505,322.12	200	3,505,522.12	3,505,522.12
Tombigbee and Warrior Rivers (Ala. and Miss.).....	1872	319,000.00		319,000.00	319,000.00
Wabash River (Ind. and Ill.).....	1828	624,000.00	500	624,500.00	624,500.00
Waccamaw River (N. C. and S. C.).....	1880	50,400.00		50,400.00	50,400.00
White, Black, and St. Francis Rivers (Ark. and Mo.).....	1823		2,500	2,500.00	2,500.00
Willamette and Yamhill Rivers. (See Willamette, Upper.)					
Yellowstone River (Dak. and Mont.)	1879	118,750.00		118,750.00	118,750.00
Western Rivers, removing obstruc- tions on:					
Construction of snag and dredge boats.....	1852	846,000.00		846,000.00	

APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by Rivers, etc.
Miscellaneous—Continued.					
Western Rivers, removing obstructions on—Continued.					
Mississippi and Missouri Rivers.	1836	\$100,000.00		\$100,000.00	
Mississippi and Ohio Rivers.....	1820	632,800.05	\$5,000	637,800.05	
Mississippi, Missouri, and Arkansas Rivers.....	1870	1,400,000.00		1,400,000.00	
Mississippi, Missouri, and Ohio Rivers.....	1832	223,000.00		223,000.00	
Mississippi, Missouri, Ohio, and Arkansas Rivers.....	1842	980,000.00		980,000.00	\$4,186,800.05
Northern and northwestern lakes:					
Construction of dredges for.....	1836	122,682.96		122,682.96	122,682.96
Survey of.....	1841		2,973,879	2,973,879.00	
Charts of.....	1849		130,000	130,000.00	3,103,879.00
Surveys, general:					
Works on Atlantic coast.....	1866		60,000	60,000.00	60,000.00
Works on Pacific coast.....	1866		50,000	50,000.00	50,000.00
Works on northern and northwestern lakes.....	1866		175,000	175,000.00	175,000.00
Western and northwestern rivers.....	1819		286,000	286,000.00	286,000.00
Transportation routes.....	1874		230,000	230,000.00	230,000.00
Examinations, surveys, and contingencies ⁽²⁾	1824		2,219,563	2,219,563.00	2,219,563.00
Repair and preservation of rivers and harbors ⁽³⁾	1841	215,000.00		215,000.00	215,000.00
Grand totals ⁽²⁾		176,491,906.62	8,021,334	184,513,239.52	184,513,239.52

NOTES.

- ¹See also "Miscellaneous," Tombigbee and Warrior Rivers.
- ²See also "Miscellaneous," White, Black, and St. Francis Rivers.
- ³Includes \$154,927.27 for rock removal.
- ⁴Includes \$23,471.57 for Saybrook Bar.
- ⁵Includes Potomac River at Washington, D. C.
- ⁶See also "Miscellaneous," St. John's and St. Mary's Rivers.
- ⁷See also Savannah, Ockmulgee, and Flint Rivers.
- ⁸Includes \$153,995.74 from the indefinite appropriation for care and operation of canals, etc.
- ⁹Includes \$34,084.40 from the indefinite appropriation for care and operation of canals, etc.
- ¹⁰Includes \$197,208.22 from the indefinite appropriation for care and operation of canals, etc.
- ¹¹Includes \$115,000 for removal of wreck of steamer *Scotland*.
- ¹²Includes \$40,837 from indefinite appropriation for care and operation of canals, etc.
- ¹³Includes \$113,817 for land damages and \$176,550 from the indefinite appropriation for the care and operation of canals, etc.
- ¹⁴The acts of March 3, 1825, and March 2, 1829, provided for the purchase of 2,250 shares of the Chesapeake and Delaware Canal.
- ¹⁵The acts of May 18, 1826, and March 2, 1829, provided for the purchase of 800 shares of canal stock, and appropriated \$150,000 for completion of canal.
- ¹⁶Includes appropriations for special points lying within these limits.
- ¹⁷Includes \$43,000 for trial of Adams's flume.
- ¹⁸Includes \$125,000 for construction of dry-dock, and \$335,500 from indefinite appropriation for care and operation of canals, etc.
- ¹⁹Includes \$5,525,000 paid to James B. Eads to June 30, 1888, for the improvement of South Pass.
- ²⁰Includes \$24,400 from the indefinite appropriation for care and operation of canals, etc.
- ²¹Includes \$40,435 for Davis Island lock and dam, from the indefinite appropriation for care and operation of canals, etc.
- ²²Includes \$1,250,000 for purchase of the Louisville and Portland Canal as provided for in act of March 3, 1873, also \$426,657.91 from the indefinite appropriation for care and operation of canals, etc. The acts of May 13, 1826, and March 2, 1829, provided for the purchase by the United States of 2,350 shares of canal stock.
- ²³Of this amount \$429,563 was appropriated between 1824 and 1846, for survey of canals, roads, etc., the balance between 1870 and 1888, inclusive, for examinations, surveys, and contingencies.
- ²⁴In addition to this amount the acts of June 28, 1864, July 25, 1868, and April 10, 1869, appropriated an aggregate of \$3,750,000 for the repair and extension of public works on rivers and harbors. This amount was allotted to various works, and is included in this table under the several works to which it was distributed.
- ²⁵These aggregates do not include the following: Re-appropriations, \$181,606.27; transportation and fuel, \$2,127.12; and allotments from the indefinite appropriation for the removal of wrecks. The aggregates do include the sum of \$319,025.17 carried to the surplus fund.

PRIVATE, CORPORATE, and STATE WORK on Rivers and Harbors.

(Continued from Vol. 1, pages 38-41.)

[NOTE.—For references and details, see the index to each work.]

Names of works.	Work done.	By—	Amount expended.
Amite River, La.....	Removal of obstructions	State.....	\$75,000.00
Appomattox River, Va.....	Dredge construction.....	City of Petersburg.....	Unknown.
Aransas Pass and Bay, Tex.....	General improvements.....	Citizens	\$10,000.00
Atchafalaya River, La.....	Removal of obstructions	State.....	Unknown.
Barataria Bay, La.....	Canal construction	Canal Company	
Big Sandy River, W. Va. and Ky.....	General improvements.....	State of Kentucky.....	\$75,000.00
Black Rock Harbor, Conn.....	Dredging	Citizens	Unknown.
Calumet River, Ill.....	Channel excavation	Town of Hyde Park.....	Do.
Cape Fear River, N. C. (below Wilmington).....	General improvements.....	State (1822-1829).....	\$70,000.00
Charleston Neck, S. C.....	Canal construction	State.....	15,000.00
Columbia River (Lower), Oregon.....	Bar sluicing	Board of Trade and Oregon Railroad and Navigation Company.....	8,000.00
.....dodo	Board of Trade and steam-ship lines.....	2,500.00
.....dodo	Steam-ship lines.....	10,000.00
.....do	Dredging and removal of obstructions.....	City of Portland.....	Unknown.
.....do	Dredgingdo	\$7,442.00
.....do	Dredge constructiondo	15,000.00
Coos Bay, Oregon.....	Opening quarry	Citizens	811.25
Coquille River, Oregon.....	Construction of jetty.....do	Unknown.
Corsica Creek, Md.....	Dredging	Citizens	\$1,200.00
Fairport Harbor, Ohio.....do	Painesville and Youngstown Railroad Company.....	Unknown.
Galveston Bay ship-channel, Tex.....	Ship-channel construction	Bayou Ship-Channel Company.....	Do.
Grand Marais, Mich.....	Dredging	Citizens	Do.
Green River, Ky.....	Dam construction	Navigation Company.....	Do.
Hudson River, N. Y.....	Dredging (120,000 cubic yards).....do	
.....do	Dike repair (960 linear feet).....	State.....	Do.
.....do	Dike repair and dredging.....do	Do.
James River, Va.....	Money appropriated, work done, and machinery placed at the disposal of the Government.....	City of Richmond	\$444,696.45
Mississippi River, Falls of St. Anthony.....	Tunnel and dam construction.....	Citizens	334,000.00
Monongahela River, Pa. and W. Va.....	Tunnel built (in 1868).....	Mill owners.....	Unknown.
Muskingum River, Ohio.....	Locks, dams, and appendages	Monongahela Navigation Company.....	\$1,960,000.00
New Orleans, La.....	Locks and dams built.....	State.....	1,500,000.00
Ohio River, Falls of.....	Breakwater built.....	City of New Orleans.....	Unknown.
.....do	Construction of Louisville and Portland Canal.....	Louisville and Portland Canal Company.....	Do.
Pawtucket River, R. I.....	Removal of obstructions	State.....	Do.
Romery Marsh, Ga.....	Dredging (99,120 cubic yards)	Citizens	Do.
Rough River, Ky.....	Lock and dam construction	Rough Creek Navigation and Manufacturing Company.....	Do.
Do	Canal, lock, and dam construction.....	State.....	Do.
St. Clair Flats Ship Canal, Mich.....	Dredging	Canadian authorities.....	\$20,000.00
St. Jerome's Creek, Md.....	Channel dredged	U. S. Fish Commission.....	* 1,200.00
St. Mary's River, Mich.....	Construction of canal.....	State.....	Unknown.
San Joaquin River, Cal.....	Dredging (21,142 cubic yards).....	City of Stockton	Do.
Saugerties Harbor, N. Y.....	Dredging (29,000 cubic yards).....	State.....	Do.
Skagit River, Wash.....	Removal of obstructions	Citizens	Do.
Tennessee River, Tenn.....	Canal commenced in 1830.....	State of Alabama	Do.
Two Rivers Harbor, Wis.....	Dredging (14,000 cubic yards).....	City of Two Rivers	Do.
Wicomico River, Md.....do	Town of Salisbury	\$1,700.00
Williamette River (Upper), Oregon.....	Canal and lock construction	Williamette Transportation Company.....	600,000.00
Yaquina Bay, Oregon.....	Jetty construction	Citizens	1,439.50

